Vol. 26 MARCH, 1905 No. 151

THE FOUNDRY

PUBLISHED MONTHLY BY
THE PENTON PUBLISHING CO.
CLEVELAND, OHIO.

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THE S. OBERMAYER CO.

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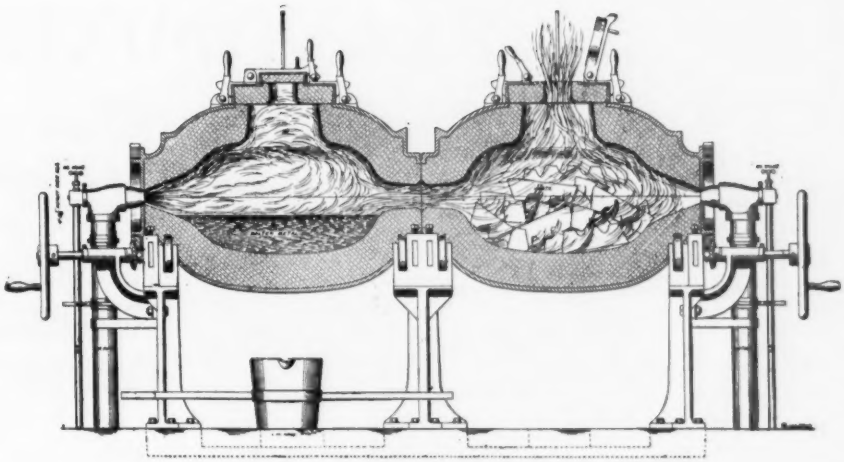

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NOTE. — In order to clearly explain the **Modus Operandi** of this scientific and practical method of **mixing Molding Sand, Facing Sand and Core Sand,** we have issued a small pamphlet which will be sent on application.

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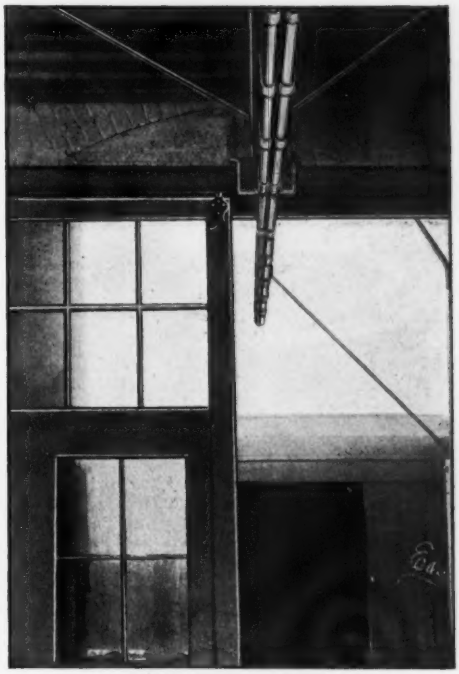
Gangways



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with small initial cost—no expenditure for power and practically none for repairs. One laborer will think it a soft job to supply a dozen molders right on their floors with all the iron they can take care of. Same trolley track will take out the castings, bring in the sand, flasks and other foundry material.

The saving in laborer's wages alone will soon pay for their installation.

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Money-saving Crucibles
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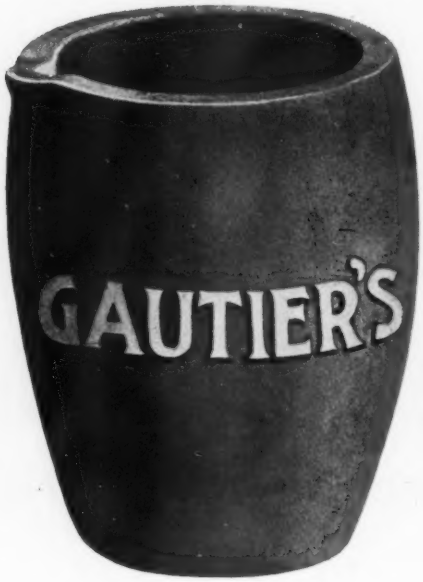

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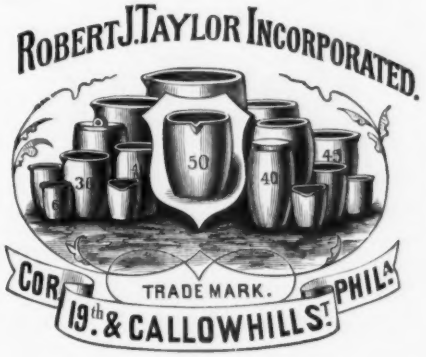

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SENECA FALLS, N. Y., Feb. 10, 1905.

The Patternmaker, Cleveland, O.

GENTLEMEN:—Referring to the results obtained from our ad now running in *The Patternmaker*, will say that the results obtained are very satisfactory indeed and that there are more inquiries on account of this ad than any we have ever placed before and we wish to testify to these good results as evinced by the many people who write and say: "We saw your ad in *The Patternmaker*." The paper is of especial advantage to us because it goes directly to the class of trade who use our goods. Wishing you a full measure of success, I am,

Yours very truly,
A. W. BRIM.

THE J. D. SMITH FOUNDRY SUPPLY CO.
Manufacturers of
Foundry Facings, Blacking and Foundry Supplies
Importers and Refiners of Plumbago and Silver Lead

CLEVELAND, O., Feb. 9, 1905.

The Patternmaker, City.

GENTLEMEN:— We are in receipt of your favor of the 4th, asking us our opinion of *The Patternmaker*. In reply, beg to say that we have carried our Ad in your paper ever since the first issue was published, and we have found the results to be much greater than we anticipated. We can say without hesitation, that we have had more direct returns from this advertisement than any we are carrying, and we are advertising in some ten trade papers. We shall be glad to continue our Ad, and wish *The Patternmaker* a great deal of success. Very truly yours,

THE J. D. SMITH FOUNDRY SUPPLY CO.
F. H. CHAMBERLIN, Pres. & Mgr.

Thousands of skilled Mechanics read its advertising pages. Pays others—'twill you

Your ad should be in the next issue.

THE PATTERNMAKER **Cleveland, Ohio**

THE PATTERNMAKER

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R. S. McDOWELL, Sharon, Pa.

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"I think you have a great magazine — one that has long been needed." R. W. MACDOWELL, Uniontown, Pa.

"Your publication is a most exemplary one, so bright and instructive in its reading, so liberal and elegant in illustrations—a veritable blessing to me and my craft." FREDERICK LEHMAN, Sheridanville, Pa.

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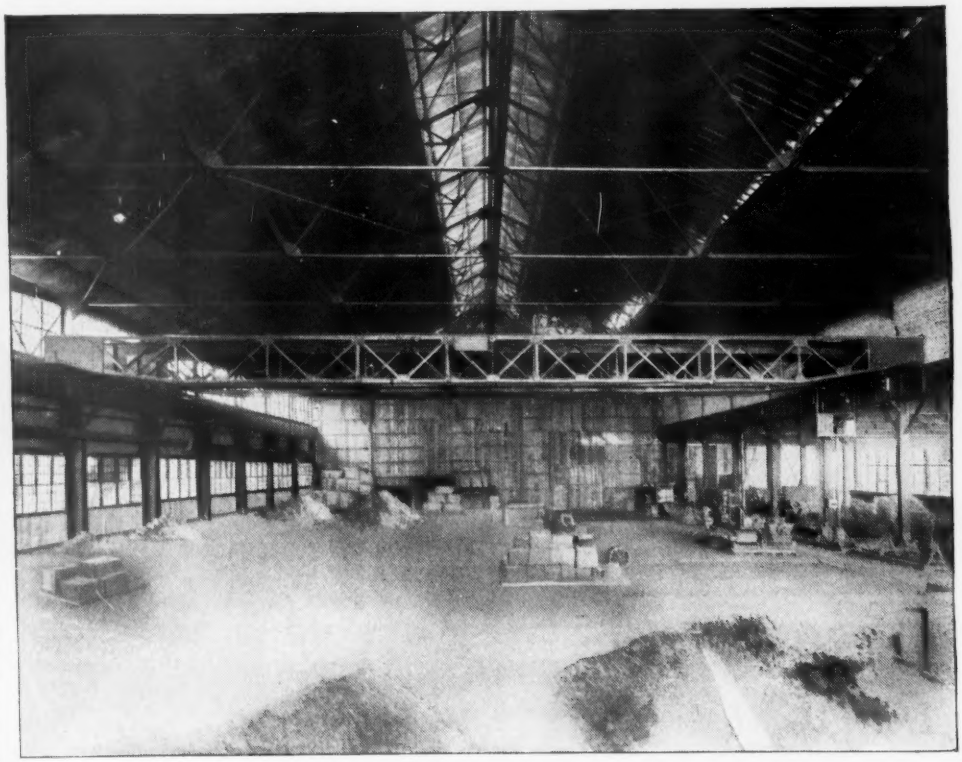
Worth many times its cost—$1.00 a year

(To foreign countries, $2.00)

A sample copy of this practical paper for progressive patternmakers awaits your address.

THE PATTERNMAKER Cleveland, Ohio



Three-motor Electric Traveler, 10 tons capacity, 98-ft. span. Furnished McCormick Division, International Harvester Co., Chicago.

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ENGINEERS, DESIGNERS AND MANUFACTURERS

COMPLETE EQUIPMENT FOR GRAY IRON, CAR WHEEL AND PIPE FOUNDRIES

MALLEABLE AND STEEL CASTING PLANTS

ALL TYPES

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OVER 1500 IN USE

Awarded Gold Medal for Cupolas and Cranes at World's Fair St. Louis 1904.

WHITING FOUNDRY EQUIPMENT CO.

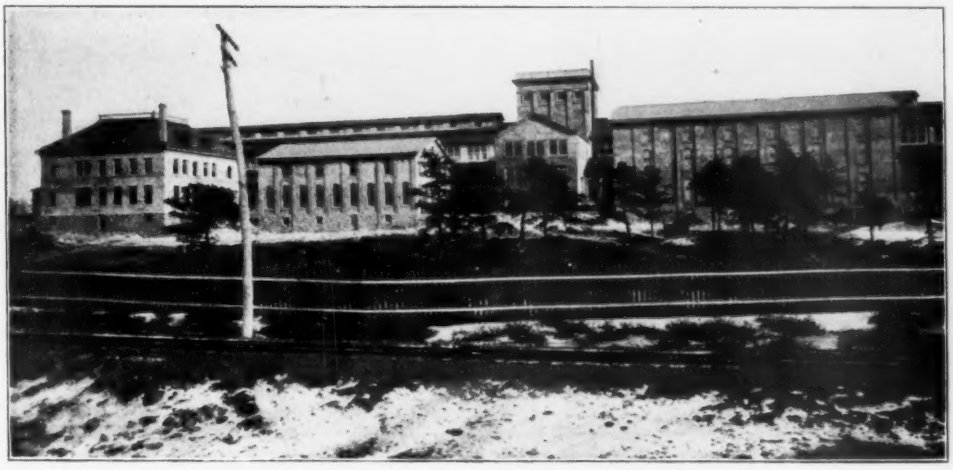
GENERAL OFFICE AND WORKS: HARVEY, ILL., U. S. A. (CHICAGO SUBURB)

THE FOUNDRY

Vol. 26, No. 1. *CLEVELAND, OHIO, MARCH, 1905.* *Whole No. 151*

Foundry of the Jeanesville Iron Works.

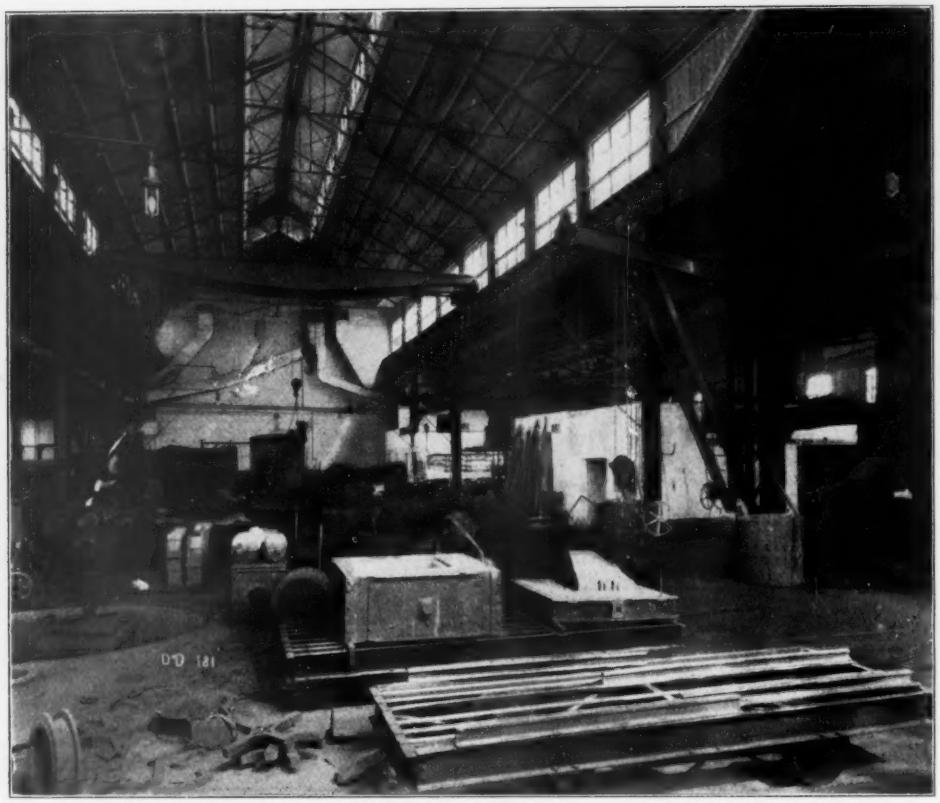
The Jeanesville Iron Works is the natural outgrowth of the mining conditions of the anthracite region. The plant was formerly located at Jeanesville, in the Hazleton region. The owners made a careful study of the mining conditions and designed pumping machinery especially suited to meet those conditions. The result was that Jeanesville pumps became noted the world over as a superior class of mining pumps. The business finally outgrew the old plant at Jeanesville and they cast about for a new building site. The most available and best located site to be found was in Hazleton, only a few miles from their old works. Desiring to have the most efficient plant possible they made a careful study of the best modern plants along their line, employing Messrs. Ballinger & Perrot of Philadelphia, as architects for the buildings, and Messrs. Dodge & Day, of Nicetown, Philadelphia, Pa., as experts to look after the mechanical equipment. The plant has been designed in such a way that it is capable of expansion in all directions. The buildings are of concrete construction and either fire-proof or of slow burning construction for the interior works. Owing to the fact that they are located outside of the fire district of Hazleton, the architects constructed a tower in the center of the works. This tower is over the cleaning department. The story immediately above the cleaning department contains the engines and heating coils for use in connection with the American Blower Co.'s heating system. Above this room is located a 30,000 gal. capacity tank which contains the service supply for the entire works. There is always a sufficient volume of water on hand to fight any ordinary fire, but as a reserve they have constructed a 350,000 gal. capacity reservoir on the high ground back of the plant and installed a large fire pump to be used in case of emergency.



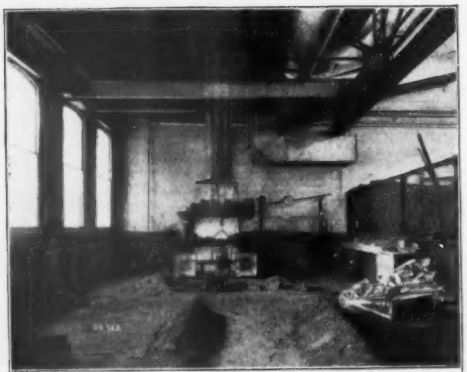
JEANESVILLE IRON WORKS.

The water supply for the works is from an artesian well.

The iron foundry is located in a building 107 by 192 feet. The central bay of the foundry is 50 feet wide and is provided with a traveling crane of 20 tons capacity, with 5 tons auxiliary, also with two wall jib cranes and two pillar cranes arranged to swing around the entire circle of 5 tons capacity each. In addition to this, there is a floor controlled electric traveling crane over the core department of 5 tons capacity, and another over the side bay of 5 tons capacity. The crane in the main bay is so arranged that it can pass out through



INTERIOR OF IRON FOUNDRY.



1. BRASS FOUNDRY. 2. CORE DEPARTMENT.

an opening in the end of the building and over a runway in flask yard equal to the length of the foundry. This runway is so constructed that if it was ever desired to continue the foundry the posts of the runway will form the main posts in the structural work for the additional building.

In order to take care of their special work, they have provided two pits in the foundry floor, one for cylinders and the other for plungers. These pits are served by the pillar cranes, and are also under the runway of the main traveling crane. Many of their molds are made in dry sand and require baking and hence two large mold-drying ovens have been provided at the end of the foundry. Adjoining these are located the cupolas, one of 60 inches diameter, and the other of 45 inches diameter inside the lining. Blast is furnished for the cupolas by a positive, motor driven blower in an adjoining room. The core department is located on the same side of the room as the cupolas, and there is a double core oven at the end of the department. The storage bins and department for preparing sand are also on

1. CUPOLA AND OVENS FOR DRYING MOLDS.

2. CLEANING DEPARTMENT.

this side of the foundry. The central bay is devoted to the heavy work, while a portion of the bay opposite the cupolas is devoted to light work and the balance to the brass foundry. The foreman's office is situated about midway in the length of the foundry and opposite the cupolas. One thing that has been taken into special account in designing the plant has been to arrange it so that everything would move through in a continuous line. The pig iron, coal, etc., are brought in on tracks at the foundry end of the plant. An elevated track is provided, with bins beneath it for the storage of various materials used in the foundry, and this track also runs over the coal bins at the power plant. The castings pass from the foundry directly into the cleaning department, which is equipped throughout with pneumatic tools, including 2 10 ton pneumatic traveling cranes for handling castings. From the cleaning department castings pass directly into the machine shop.

Pneumatic tools are used throughout the shop in all cases in which they will facilitate the work. Among other appliances, a drop weight for breaking heavy scrap has been installed in the yard and arranged to operate with a pneumatic hoist. The brass foundry is separated from the iron foundry by an expanded metal partition.

The foundry is lighted by what might be called a double monitor roof. In the first place, there is a monitor roof over the central bay with windows along the sides, and above this, over the center of the main bay, there is a ventilator with windows along both sides. These windows, together with the side windows, afford ample light.

FOUNDRY YARD.

FOUNDRY BLACKINGS.

N. W. SHED.

What are blackings made of?

The question is commonly answered by saying, black lead or plumbago. It is true that many blackings contain more or less black lead; but, on the other hand, it is true that a great many blackings contain no black lead at all. The question might be answered by saying, coal. This answer would be nearer right, for probably three-fourths of the blacking used in the United States is made out of hard coal pulverized. Hard coal is generally regarded as being quite uniform in composition, yet there is a marked difference in the various hard coal blackings.

As an instance of this, the experience of a cast iron pipe maker may be valuable. This manufacturer had begun using a new lot of blacking and soon noticed that the sand stuck to the pipes, giving them a very rough appearance. He went to the blacking dealer and said: "Your last lot of blacking is not good." "I am sure it is all right," replied the dealer. "Just the same as we have been sending you." But the pipe man was not satisfied and sent samples of the old and the new blacking to a foundry chemist, with these results:

GOOD BLACKING.

Ash	10 percent
Solid carbon	83 "

POOR BLACKING.

Ash	18 percent
Solid carbon	75 "

This proved that there was a decided difference in the blacking and also showed that the blacking with low ash and high carbon kept the sand from sticking to the casting. The poor blacking was made of a slaty, hard coal, what the miners call bone coal; this is the refuse of the anthracite breakers and can be obtained for little or nothing. The good blacking was made from a good quality of hard coal.

For some classes of work, such as ingot molds, an inferior blacking will do very well and the saving in expense is considerable. A sample of ingot mold blacking recently analyzed in the Foundrymen's Laboratory showed:

Ash	24.70
Solid carbon	72.90

This blacking had very little volatile matter and this indicates that it is made not from hard coal, but from coke, ground very fine.

For small castings, requiring a very smooth surface, a much finer quality of blacking is used. These blackings contain a large quantity of plumbago, yet the blacking maker is prone to put in as small a quantity of plumbago as possible and yet have the blacking fill the bill.

A plumbago blacking, called by the trade pure plumbago, had this composition:

Ash	47 percent
Volatile matter	7 "
Solid carbon	46 "

This is very far from pure plumbago, which should be 100 percent carbon or graphite. The graphite as mined has usually many mineral impurities and to this impure graphite a large amount of soapstone is added, making a product which masquerades as plumbago. It is very common to find 50 percent soapstone in plumbago blackings. In fact, there is very little pure plumbago sold for foundry use.

It would seem reasonable to demand that when pure plumbago is wanted it should be at least 75 percent pure.

The pure graphite can be recognized by its occurring in little scales with a bluish black lustre. When dropped into water these scales tend to float. If the dry plumbago is rubbed upon a porcelain plate the streak will have a greenish hue. With a good lens or small microscope the flakes of graphite may be readily distinguished from the impurities. Feldspar is often used as an adulterant and can be recognized by its cleavage.

As there are white blackbirds, so there are white blackings. Under this head are the various grades of talc or soapstone which can be used alone for some kinds of work.

Among the white blackings are preparations of infusorial earth, which is very fine silica. Another light blacking is lycopodium, which is a pale yellow dust composed of the spores of a fern-like plant. The latter are used mainly in fine steel and brass castings.

A near relative of the hard coal blacking is the sea coal facing.

In some foundries the blackings are called facings and the supply houses ship plumbago as a facing. The sea coal used with sand at the face of the mold is generally called facing. This facing, to be efficient, must give off considerable gas when the iron strikes it, and therefore bituminous coal, usually called soft coal, is used.

The name sea coal probably comes from the fact that the soft coal in England was com-

monly shipped by way of the sea. The name means nothing here for the soft coal used in foundries rarely visits the sea.

An extremely gassy sea coal should be avoided. Some prefer the Pittsburg coal with about 32 percent of gas or volatile matter, while many like the semi-bituminous coals of Central Pennsylvania and Maryland, containing about 22 percent volatile matter.

Westmoreland County, Pa., has shipped a large amount of satisfactory sea coal.

The best method of testing blackings and facings is by burning.

A small quantity is weighed in a platmine crucible, the crucible is covered and heated to a red heat for three minutes. This will drive off the volatile matter. The crucible is cooled and weighed; the loss in weight gives the amount of volatile matter or gas. The residue in the crucible is now like coke. The crucible is placed on its side and heated to a bright red for several minutes, stirring the contents occasionally. The ash appears gray or white, When no black particles are visible, remove the crucible from the flame and weigh again. The last weight gives the amount of ash. The solid or fixed carbon is found by adding the percentage of volatile matter to the percentage of ash and subtracting from 100.

In many of the adulterated plumbago blackings the ash will melt, owing to the adulterant present making a flux with the silicious matter of the impure graphite.

The volatile matter will usually decide whether the blacking is made of ground coal or ground coke. A ground hard coal will usually show 7 percent volatile matter. A ground coke shows usually less than 3 percent. The method of testing shown above is short and inexpensive. It would pay every foundryman to test what he calls a good blacking and when he buys a new supply hold the manufacturer to this test. This would avoid the loss and annoyance caused by poor blackings which are now being floated on the unsuspecting foundryman.

Foundrymen's Laboratory, Buffalo, N. Y.

Henry Robertson, of Wadena, Minn., has leased a foundry and machine shop at Long Prairie, Minn., and expects to place it in operation before long.

The iron foundry of Geary & Powell, of Jersey City, N. J., is now being equipped and they expect to have it completed by March 1st. The shop is 50 by 100 ft. They expect to do machinery and general jobbing work.

PRACTICAL METHODS OF ANALYSIS FOR BRASSES AND BRONZES.

BY W. W. CORSE.

The alloys of copper, classed under the general heads of brasses and bronzes, may, besides copper, contain tin, lead or zinc in any combination up to 40 percent of the total formula. Antimony, iron phosphorus and sulphur may also be present, but usually in small amounts. There are also brasses containing 2 to 3 percent of aluminum and what are known as aluminum bronzes, carrying generally about 10 percent of aluminum with 90 percent of copper.

For practical purposes it is generally sufficient to determine any or all of the first four metals mentioned and therefore only the methods applicable to these will be considered here.

If the metal is what the foundryman calls yellow, the copper content will be between 60 and 75 percent; if it is what is known as red or steam metal, it will be between 75 and 90 percent. The tin content may be as low as a few tenths of a percent in yellow metal for rolling purposes, or as high as 10 to 15 percent in gun metal or bell metal for casting purposes. The lead content varies similarly from a few tenths of a percent in rolling metal to 15 or even 30 percent in metal suitable for bearings. The average lead content in red metal is between 3 and 5 percent. Zinc varies from 2 percent in the familiar 88-10-2 gun metal mixture to 40 percent in Memtz metal for rolling purposes. The average content for yellow metal is between 25 and 30 percent and for red metal 5 to 10 percent.

Methods of Analysis.

The procedure is as follows:

Weigh out 2.5 grams of the sample into a 250 cc. beaker, add sufficient water to cover it, cover the beaker with a watch glass, add 10 cc. of nitric acid (sp. gr. 1.42) and warm until all metallic particles are dissolved. Now add hot water to make the volume of the solution 40 cc. and boil five minutes to insure the complete precipitation of the tin. If no white residue appears at this point it shows absence of tin. Antimony would appear here also if present. If a white residue is formed, filter and wash with 2 percent nitric acid to insure the complete removal of copper, dry, ignite in a porcelain crucible and weigh as stannic oxide ($Sn. O_2$). From this calculate the percentage of tin present. Stannic oxide generally carries down a small amount of the other metallic salts present in the solution, which

causes the results to come about 0.1 percent high for every percent of tin present. If very accurate results are desired, the precipitate may be purified by fusion and reprecipitation, but this is seldom necessary.

To the filtrate from the tin, which should be in a porcelain dish or casserole, add 10 cc. of sulfuric acid (sp. gr. 1.84), and set on the steam bath until all the nitric acid has evaporated. An indication of this is a change of color from a deep to a pale blue. The best way is to arrange the work so that this evaporation will take place over night as then no time is lost.

Some prefer to evaporate off the nitric acid over a naked flame, but it is the writer's experience that the time gained is more than offset by the danger of loss by spurting.

Then add 125 cc. of water to the casserole and boil until the sulfates of copper and zinc are dissolved. Allow to cool, then filter off the lead sulfate and wash with dilute sulfuric acid 1:20 to remove the copper and zinc. Remove the beaker containing the filtrate and finish the washing with a mixture of alcohol and water 1:1 to remove the sulfuric acid. The latter washing is necessary because any sulfuric acid remaining in the filter will char it and make it difficult to handle during ignition. Dry the lead sulfate on the filter, then remove it to glazed paper by means of a spatula and camel's hair brush. Suspend the filter over a porcelain crucible, by means of a platinum wire, ignite it, allowing the ash to fall into the crucible. Now add two drops of nitric acid (sp. gr. 1.42) and one drop of sulfuric acid (sp. gr. 1.84) and heat gently until the white fumes of sulfuric anhydride are expelled. This changes any lead that may have been reduced by the burning paper, back to sulfate. Replace the main portion of the precipitate in the crucible and ignite it at a red heat for a few minutes. Weigh as lead sulfate, from which calculate the percentage of metallic lead.

*A volumetric method for lead using ammonium persulfate has been carried out by Walters and Affelder, which cuts down the time very materially, but the writer's experience with it has been that low results are liable to be obtained through incomplete oxidation of the lead by the persulfate. More exact conditions for precipitation may remedy this defect.

Make the filtrate from the lead sulfate up to 500 cc. in a volumetric flask. If several analyses are being carried on at once it is generally convenient to put this solution into a bottle to be taken out as needed.

For the determination of copper the method used is that of Low.*

"Standardization of the Thiosulfate Solution. —Prepare a solution of sodium thiosulfate containing about 19 grams of the pure crystals to the liter. Standardize as follows: Weigh accurately about 0.200 gram of pure copper foil and place in a flask of about 250 cc. capacity. Dissolve by warming with 5 cc. of a mixture of equal volumes of strong nitric acid (sp. gr. 1.42) and water and then dilute to about 50 cc. Boil for a few moments to partially expel the red fumes and then add 5 cc. of strong bromine water and boil until the bromine is thoroughly expelled. The bromine is to ensure the complete destruction or removal of the red fumes. Remove from the heat and add a slight excess of strong ammonia water. Ordinarily it suffices to add 7 cc. of ammonia water of .90 sp. gr. Again boil until the excess of ammonia is expelled as shown by a change of color of the liquid and a partial precipitation of the copper hydroxide or oxide. Now add strong acetic acid in slight excess, perhaps 3 or 4 cc. of the 80 per cent acid in all, and boil again for a moment if necessary to redissolve the copper. Cool to room temperature and add about 3 grams of potassium iodide, or 6 cc. of a solution of the salt containing 50 grams in 100 cc. Cuprous iodide will be precipitated and iodine liberated according to the reaction

$$2\,(Cu.2\,C_2H_3O_2) + 4KI = Cu_2I_2 + 4\,(K.C_2H_3O_2) + 2I.$$

The free iodine colors the mixture brown. Titrate at once with the thiosulfate solution until the brown tinge has become weak and then add sufficient starch liquor to produce a marked blue coloration. Continue the titration cautiously until the color due to free iodine has entirely vanished. The blue color changes towards the end to a faint lilac. If at this point the thiosulfate be added drop by drop and a little time be allowed for complete reaction after each addition, there is no difficulty in hitting the end-point within a single drop. 1 cc. of the thiosulfate solution will be found to correspond to about 0.0005 gram of copper. The reaction between the thiosulfate and the iodine is

$$2\,(Na_2S_2O_3) + 2\,I = 2\,NaI + Na_2S_4O_6.$$

Sodium iodide and tetrathionate are formed. The starch liquor may be made by boiling about 0.5 gram of starch with a little water

*Jour. Amer. Chem. Soc., June, 1903, XXV. 632.

*Jour. Amer. Chem. Soc., Nov., 1902, XXIV. 1082.

and diluting with hot water to about 250 cc. The liquor should be homogeneous and free from lumps or grains. It should be used cold and must be prepared frequently, as it does not keep well. The thiosulfate solution made from the pure crystals and distilled water appears to be quite stable, showing little or no variation in a month under reasonable conditions."

Treatment of sample.—Take an aliquot portion of the 500 cc. solution equivalent to 0.2 gram of copper, generally 50 cc., add ammonia, boil off excess, add acetic acid and titrate exactly as described for the standardization. Calculate the percentage of copper from the volume of the thiosulfate solution used. Zinc does not interfere with the method.

If the sample is being analyzed to check the furnace man, or to get the approximate mixture used either for the foundry chemist or a customer, it is sufficient, as all the methods used are very accurate, to add the results for tin, lead and copper and obtain the zinc by difference. If, however, the analysis is being made to determine the loss of zinc by volatilization in order to figure out a formula to use in connection with either a crucible furnace or one of the many forms of oil furnaces which are now on the market, it becomes necessary to determine the zinc exactly.

The method used is gravimetric and depends on the precipitation of zinc as zinc ammonium phosphate and its subsequent ignition to zinc pyrophosphate. It is carried out as follows: Take an aliquot portion of the 500 cc. solution from which the portion for copper was taken equivalent to 0.1 to 0.2 gram of zinc, generally 250 cc. To remove the copper add 25 cc. of sulfurous acid, heat to boiling and add 5-6 grams of ammonium sulfocyanate. If the precipitate of copper sufocyanate is not white or cream color, add more sulfurous acid. Allow the precipitate to settle, then filter off and wash with hot water. Use a fine filter or some paper pulp, as the precipitate sometimes has a tendency to run through. To the filtrate from the copper sulfocyanate add 25 cc. of ammonia water (sp. gr. .90) or enough to make it strongly alkaline, and 50 cc. of a 10 per cent solution of ammonium phosphate. The presence of an excess of ammonium phosphate decreases the solubility of the zinc ammonium phosphate. Make up to approximately 500 cc., heat to boiling and cautiously neutralize with nitric acid (sp. gr. 1.20) added from a dropper, until a slight permanent turbidity is produced. Then discontinue the addition of nitric acid and add dilute acetic acid (1:25), 1 cc. at a time from a dropper. Continue the addition until only a faint odor of ammonia is perceptible. Heat the solution up again to boiling and stir until the precipitate is granular. If the precipitate does not become granular after considerable stirring, it sometimes will do so by dissolving it in ammonia and reprecipitating in the manner described. Filter off the precipitate of zinc ammonium phosphate, wash with cold water, ignite carefully in platinum, and weigh as zinc pyrophosphate (Zn_2PO_7). From this weight calculate the percentage of zinc present.

The copper may also be removed, before precipitating the zinc, by hydrogen sulfide, but the separation by ammonium sulfocyanate and sulfurous acid is much the neater of the two.

Remarks.

While the methods are all standard, the details have been given in full so that the man with an occasional analysis of brass to do will not have to work them out for himself.

These methods are published in the hope that the results coming from their use may show how important it is to regulate the composition of the metal and how many economies may be practiced, if an accurate knowledge of its composition is at hand for reference from day to day. It is the firm belief of those who have made the matter a close study that chemical analysis can do as much for the brass foundry as for the iron foundry and the sooner we realize the fact, the sooner will the brass foundry occupy the place which its history and usefulness demand.

A FOUNDRY EXPERIENCE.

BY C. VICKERS.

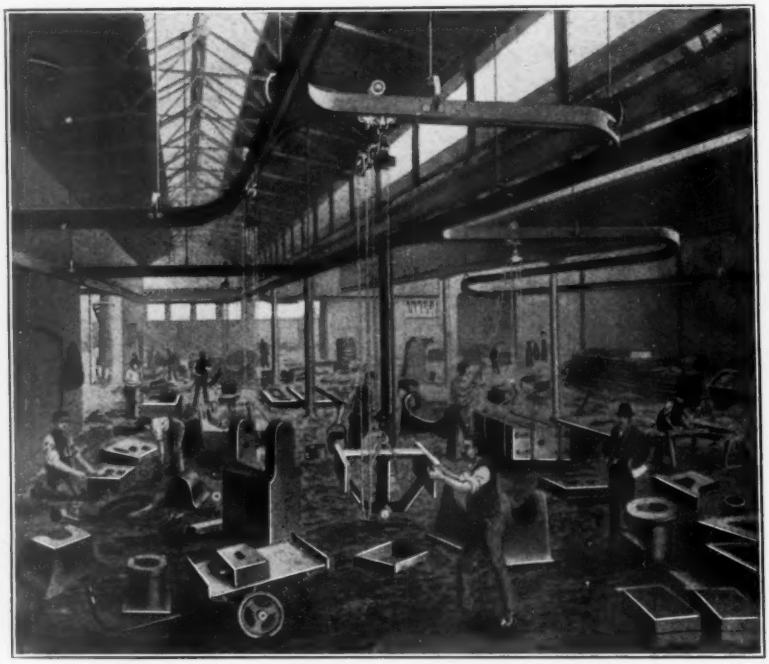
The story of the Dismal Swamp Foundry was enjoyable reading, although the experience itself might not have been.

It reminded me of a shop that also had a few peculiarities. This foundry was located in a southern state, and the class of work was stoves, sash weights, columns, sidewalk lights, castings for windmills, and in fact any old thing, even engine brasses when they could get them.

Amongst their peculiarities was a human traveling crane. This "crane" was composed of colored persons, and poor white trash, and was used to carry the metal for comparatively heavy castings to distant parts of the rambling old building.

Probably these comparatively heavy castings never weighed a ton, but the "crane" had a staggering and most profane time, carrying half that quantity of metal, from the cupola to the mold, arrived at which the ladle was placed on horses and filled up with bull ladles. When we started out, the ladle did not look so big, but the way it grew, on its progress to the mold, and the number of ladles of iron it swallowed, when there, was astonishing.

The heaviest work was made within reach of the jib crane, which of course included the cupola within its sweep. It was a wooden affair equipped with a rope, said rope being more or less frayed. I was more afraid of the jib crane than of the traveling crane, and I think of the two it was the noisier and most decrepit.



OVERHEAD TRACTION FOR FOUNDRIES.

There was a small machine shop connected with the plant, six p. m. was the machinists' quitting time, and was supposed to be ours, only our foreman mistook the whistle as the signal for putting on the blast so we were too busy to think of going home, until from 7 to 8 o'clock, long before which time it was dark, and as it had never occurred to the proprietors to provide any kind of illumination in the foundry, it was up to the foreman to do something in that line, and he arose to the occasion by installing a private gas plant. He procured a dome of heavy sheet iron about three feet in diameter, in the center of the dome was a hole, in the hole was screwed about four feet of 1-inch gas pipe, which terminated in a common burner minus the tip.

The gas plant was operated by placing this dome over a hole dug in the floor, the hole contained a wheelbarrow of soft coal. The first ladle of iron was dumped into this hole, through an opening left for the purpose, which opening and all other openings around the dome were then stopped up with sand in the same manner and with the same ceremonies that are observed in "stopping up" a leak in a mold. A light was then applied to the burner and a flame flared up that made an effective torch, while it lasted.

This illuminated the scene around the cupola, the more remote corners of the shop being "lighted" by bits of waste burning in shallow tins of oil.

The roof of this shop was propped up by pieces of old rails from a convenient railroad and in the smoke, steam and gloom of casting time, these rails were invisible and collisions not unfrequently occurred.

It was one of these collisions in which I figured, together with a bull ladle of iron,

which convinced me my health was too delicate for the job. So when through that night, I tumbled out of a window, for I could not find any door and gathering together my pieces from amongst the flasks, boards and things that had gently broken my fall, I wiped the tears from my smoke-blinded eyes and shook the sand of that "foundry" from my shoes forever.

OVERHEAD TRACTION FOR FOUNDRIES.

The firm of Rowland Priest, of Cradley Heath, Eng., has developed a method of overhead traction for shops and foundries. The system has been especially designed to meet the requirements of those desiring as simple and inexpensive a construction as possible. The company has made a flat bar runway which is devoid of levers, springs, switches or cords at the cross-over points. The arrangement consists of a pair of flat iron bars running parallel and on edge with sufficient space between for the carriage, the latter being suspended by two rollers running side by side on the top edges of the rails. The rolls are fitted with ball bearings and easily twisted around in a horizontal plane by a corresponding turning of the load beneath. This slight twist—and in practice it is said to be almost imperceptible—of the load operates on two guide rollers acting between the rails. These guide rollers are fixed fore and aft of the two main rollers and thus direct the carriage to any desired angle for running smoothly over the junctions of the rails without jerking or cramping of the carriage. The makers claim for the device: Easy handling of the load along the rails which being flat ensure a smooth motion; moving over rail junctions merely by slight twisting of the load in the direction it should travel; freedom from sticking at junctions or impediment to motion by rollers dropping into openings as the supporting rollers are of sufficient width to avoid any danger of this kind and the carriage will run readily around a 2-ft. curve.

A PATENT FLASK PIN.

James Cunningham, of Florence, Mass., has a patented pin connection for aligning the cope and drag of a flask and clamping them together. The pin can be inserted from above or below the bracket lugs and may be withdrawn and used for other flasks, etc.

The three first views show the pin applied to the two sections of a flask. A bracket comprising a plate and ear A is fastened by screws to the cope and a similar bracket is attached to the drag, both brackets being in the same vertical plane. The ears project forward from the plates and have slots B. On the side of the ears near the supporting plates are cam surfaces C, one of them starting from the side of the forward slot B and ending at the corresponding side of the rear slot B, increasing in thickness from front to back. A similar cam surface is around the other side of the opening through the ear. Flanges are formed on

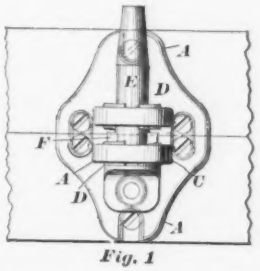


Fig. 1

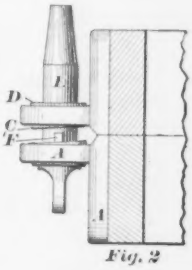


Fig. 2

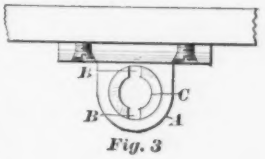


Fig. 3

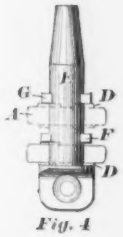


Fig. 4

A PATENT FLASK PIN.

the ears as at D as bearing surfaces for the head of a pin E. These flanges bound opposite sides of the holes and slots in a similar manner to the cam surfaces C.

The pin E has the head at one end and oppositely disposed lugs F intermediate of the head and the other end of the pin. The pin E fits the hole in the lug and the projections F slide through the slots and when the pin is turned ride on the cam surfaces C. The rotation of the pin locks the ear between the lugs and the head.

In addition to providing means for aligning the halves of a flask it may be necessary to fasten the sections together so that the cope cannot be lifted from the drag. In Fig. 4 two additional lugs G extend from the pin E between the lugs F. These lugs are arranged to engage the flanges D on the ear through which the pin last passes when the latter is turned to bring the projections F into engagement with the cam surfaces.

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TRADE OUTLOOK.

The pig iron market has not changed greatly during February. There have been a number of quite large sales of iron, including one of 40,000 tons of Southern No. 2 foundry, at $13.50 Birmingham, and another sale of 15,000 tons of Northern No. 2 foundry at $16.00 at the furnace, and several other large sales, at about the same price. The United States Steel Corporation has purchased quite heavily, including the purchase of 30,000 tons of basic for the Pencoyd works. A number of founders who purchased iron quite heavily a few months ago have been reselling the surplus, and these re-sales have tended to keep the price from going high, and in fact, in some cases sellers have shaded slightly under the market price. The pig iron situation, however, seems to indicate a firm market. The production at present is at the rate of over 21,000,000 tons per year, and this will probably be increased to 21,500,000 tons within a very short time. In this case it is interesting to note that the largest production ever made during any calendar year in the United States was 18,000,000 tons.

The railroads are placing orders for cars more freely and this results in the placing of orders for a considerable amount of work with the malleable foundries. Other lines of malleable iron have also been more active than for some time. The gray iron foundries all over the country report an increase in business, and unless business conditions are disturbed in some way the year 1905 bids fair to be a record breaker.

Selling prices for castings, however, are still pretty close to production costs and it will take careful management on the part of the foundrymen to make profits even with the increased volume of business.

EDUCATION OF FOUNDRYMEN.

No matter what angle we approach the problem from, all interested in foundry matters are agreed upon one thing, and that is, that the continuation of American foundry practice on its present high plane necessitates the education of a large number of men as skilled molders; and second, that from these skilled molders or from some other source, must be recruited a body of men to act as foundry superintendents, foremen, and assistant foremen. The foundry problem has been seriously complicated of late years by the introduction of many methods, devices and

processes hitherto unknown. These have come from within the foundry. From without have come the demands on the part of manufacturers for castings made according to rigid specifications on the one hand, and the ever increasing variations in the composition of pig iron on the other hand. To meet these conditions, it has become necessary for some one connected with each foundry to understand the mixing of iron by analysis, either chemical or mechanical, in order to control the foundry mixture and enable the foundrymen to fill specifications.

Another point upon which there can be no disagreement is that no education is complete without a knowledge of the actual work itself, that is, without the doing of the work. If a man is to be a foreman, in the fullest sense of the word, he should primarily be a molder, or at least, have had sufficient experience in molding to be able to judge good work, both as to quality and output.

To furnish the technical knowledge necessary in connection with our modern foundry practice, those interested in foundry subjects have put forth their efforts along several different lines. First, there are the trade papers, which have published practical articles upon the subjects. Second, there are the foundrymen's associations for technical purposes, such as the American Foundrymen's Association, together with the Foundry Foremen. Third, there are the correspondence schools, with their courses in shop and foundry practice.

Thus far, no residence schools have attempted to impart foundry practice with the idea of fitting men to follow the foundry business. Practically all technical schools of the higher grade have pattern shops, machine shops and foundries in connection with their equipment, but the object of these is to familiarize the student with the processes carried on in these departments of the manufacturing concerns so that they may become more intelligent designers and draftsmen. Such shops are usually more in the nature of laboratories than in the nature of manufacturing establishments.

Realizing that the present channels were apparently not providing the future supply of foremen and skilled workmen as rapidly as the demand was increasing, many prominent manufacturers and others have been interesting themselves in the subject of technical education as applied to practical subjects. Prof. Sweet read a paper on this subject before the Engineers' Club of Syracuse recently, in which he advocated a scheme by means of which the school would own a factory and manufacture some line of goods. At the start a large number of journeymen would be employed in each department to act both as journeymen and instructors. After the school had been running three or four years, the young men in their third or fourth years would be sufficiently advanced to fill all the positions as journeymen, as far as the work was concerned, but it would be necessary to maintain a small force of journeymen to act as instructors. Prof. Sweet's idea was to have a four years' course which would include certain hours of study and certain hours of work. The exact line which a man would follow would be left for him to decide at the end of the first year, or at some time during the early portion of the course. All men would be given some experience in each department of the shop. That is, in the foundry, the pattern shop and the machine shop. They would then be given an opportunity to choose the department which they would prefer to follow and the balance of their experience would be in connection with it.

Prof. Sweet's idea was that this school would turn out especially high grade journeymen, with a sufficient amount of technical education to enable them to become foremen or superintendents after a few years of practice in actual manufacturing establishments.

The Carnegie Institute of Pittsburg also proposes to devote a considerable portion of its equipment for use along foundry lines and is planning to give instruction, especially along such lines as the foremen would require. They seem to be aiming more to fill defects in education by drawing their recruits from men who have had some experience in the shop and then giving them a sufficient amount of information to enable them to handle the problems of modern foundry foremen.

The Winona Institute, of Indianapolis, Ind., is a school which has recently moved to Indianapolis and taken the old buildings which formerly constituted one of the United States arsenals. It is the plan of those in charge of the school to introduce courses in various trades and crafts. The lithographers have already opened a school for instruction in lithography which bids fair to do very creditable work.

A call has been sent out to foundrymen throughout the country to come to the assistance of this institution by furnishing the means necessary to equip and maintain the foundry,

the object being to educate men as molders and also as foremen.

One great fault that seems to have been present in practically all attempts which have thus far been made along this line, seems to be that the educational institution was conducted along theoretically educational lines more than along practical educational lines, that the shops were run too much like laboratories and that the boys never learned to do work for work's sake, but got an idea in their heads that they wanted to get out of doing the actual work and rise to positions where they would be in charge of the work. In other words, they wanted to wear a boiled shirt and not a pair of overalls. It is certainly a laudable ambition for any one to have a desire to rise as high as possible, but many a good workman has been spoiled in the attempt to make a poor foreman, draftsman, or designer out of him.

We cannot help but feel that Prof. Sweet's plan bids fair to produce the best workmen. Prof. M. J. Higgins, now of the Norton Emery Wheel Co., of Worcester, Mass., who formerly had charge of the department of mechanical engineering in the Worcester Polytechnic Institute, of Worcester, Mass., has long advocated the idea of a half time school, in which the boys would work one-half the day in the shop and spend the other half in the school room. This idea is not very different from that advocated by Prof. Sweet.

What seems to be necessary for the carrying out of Prof. Sweet's or Mr. Higgins' idea, is not only the endowment of a school and its equipment with the necessary machinery, but the securing of a man to administer the affairs of the school who will be able to outline its policy and conduct its work in such a way that it will be primarily, if not a manufacturing establishment, at least a manufacturing school in which the young men will be imbued with the spirit which should exist in manufacturing plants.

MOLDING SAND.

The United States Geological Survey are preparing a report on the molding sand deposits of the United States, and wish to obtain the addresses of all parties owning or operating molding sand deposits, or those dealing in molding sand, so as to enable them to locate all the deposits, including molding sand for all classes of gray iron, malleable iron, steel, brass and bronze castings.

It would be a great favor, both to the Geological Survey and *The Foundry*, if all the foundrymen throughout the country would notify either this office or the department at Washington as to their source of supply for molding sand, and we hope that our friends in the foundry business will understand that this notice is intended for them and respond with a hearty good will which will make the collection of this data easy and insure reliable statistics.

CAR WHEEL CASTING DIFFICULTIES.

The writer is connected with a jobbing foundry, our specialty being railway, car and engine castings. We often have logging truck wheels and mine car wheels to make, with which we have been having varying success, the trouble being mostly the cracking of the spokes. One wheel which we make is a 16-inch flange lumber truck wheel, weighing 66 pounds, having six spokes and a light hub to bore 1½ inches. The metal in the rim and arms is about 7-16 of an inch thick and three inches deep. The pattern for this wheel was made from dimensions taken from a sample wheel furnished by a customer, who obtained it from a foundry making a specialty of this work, and hence we suppose that the design is correct. When we use No. 3 Southern pig in casting this wheel, there is little trouble. If we use car wheel scrap and pig the spokes crack. A customer recently ordered a lot of these wheels and insisted that they have chilled faces. We objected, as we had never chilled these faces before and feared cracked spokes. He insisted and agreed to pay the expense of the pattern for the chill, etc. We tried the experiment, using No. 3 pig and with the result as expected, that is, cracked spokes. The spokes and the hub were uncovered as soon as possible to equalize cooling, but the thin rim chilled too quickly. I should like to know if this could reasonably be expected to chill successfully when so thin a rim is used.

Another wheel is a 22-inch plate wheel, straight ribbed, and having a heavy hub, being used for a logging car. The axle is 3½ inches in diameter, to be pushed on with not less than 15 tons nor more than 30 tons pressure. The dimensions for this were also taken from a standard wheel. At first we made this from No. 3 pig, but the chill was not deep enough. We then added car scrap and hubs of car wheels and built a pit in which we built a fire to dry and warm it before depositing

the wheel in it. As we only cast one or two at a time, they retained their heat but a short time. In order to protect them still further a plate was placed over them while they were still hot, and they were covered with warm sand and other castings. These wheels were a little better in chill, but very hard to bore and still cracked. Sometimes the cracking occurred in pressing on the axle and sometimes shortly after when they were hit a slight blow. We also have the same trouble with our 14 and 16-inch solid plate wheels.

Now for the mine car wheels. The kind we make are 14, 16 and 18-inch spoke wheels. These are known as self-oiling mine car wheels and are made by almost all foundries in the mining districts. The accompanying sketch, Fig. 1, shows a cross section of the hub and one side of the rim. Our first experience in making these wheels was a total failure. The dimensions and drawings were furnished by a

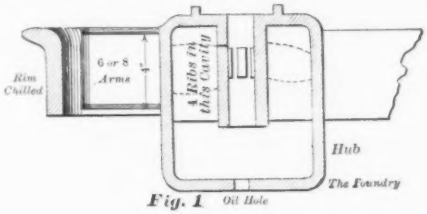


Fig. 1

mine company, and the rim and arms were about ⅞ inch thick. The metal in the hub was about ½ inch, the arms straight and the weight of the wheel about 150 pounds. Nearly every wheel had cracked spokes. We tried No. 3 pig alone, also pig and scrap, also pig, scrap and car wheels. We then changed the wheel pattern so as to use curved spokes, and made the metal ½ inch in the hub and ¾ inch in the rim and arms. By using No. 3 pig alone these were cast very successfully and bored well. They were also strong, but the chill was not satisfactory, as it was only ⅛ of an inch or less in thickness. A short time ago we ran entirely out of pig iron, and had an order for quite a lot of these wheels on which the mines were pushing shipments. The management insisted that we make them out of scrap, regardless of my protest. The wheels were cast and could hardly be bored. When they were tested by a light blow from the hammer, all cracked.

Another wheel which is giving us trouble, and which is the one that has made me decide to throw up my hands and ask for advice, was sent to us from a mining company, with the information that if we could make them satisfactorily, we could have their trade, there being no patent on the wheel. We attempted to compete for the trade. The wheel was similar in design to that shown in Fig. 1. The metal in the rim was 11-16 inch thick, the arms 11-16 inch and the metal in the hub ½ inch. The wheel had eight straight arms. We first tried making it with No. 3 pig iron, and the result was that all the spokes cracked. We next tried No. 3 pig iron and scrap, and still all the spokes cracked.

Next we tried 75 percent No. 3 pig and 25 percent car wheel scrap, and still the spokes cracked and the chill was only ⅛ of an inch or less. I then reduced the metal in the hub to ⅜ of an inch with no better results. We also tried uncovering the arms and hub, but to no purpose.

Now I believe the trouble is with our mixture, for the sample wheel furnished had a chill of about ¼ inch and we could pound it with a sledge without breaking the spokes, in fact, we broke the rim first. It is evident that the trouble is not in the design, but either in the mixture or in the method of handling in the foundry. These wheels all require a chill of about ⅛ inch for work on railroad rails. They must also be tough, so as to withstand shocks, and the hubs soft enough to bore easily. These mine car wheels are made in many foundries, and are never annealed, so far as I know. I should mention that our chills are about 2½ to 3 inches thick. We have also tried using chills from 1½ to 2 inches thick, but these thin ones crack too often. I wish that some one could tell us what core materials and treatment should be used to produce a perfectly clean hub, inside, as the least sand left in is loosened by the oil and grinds the axle.

"A SUBSCRIBER."

The Union Iron Works, of Portland, Me., have elected the following officers for the ensuing year: Chas. V. Lord, president; Linwood C. Tyler, clerk; Chas. A. Walters, general manager.

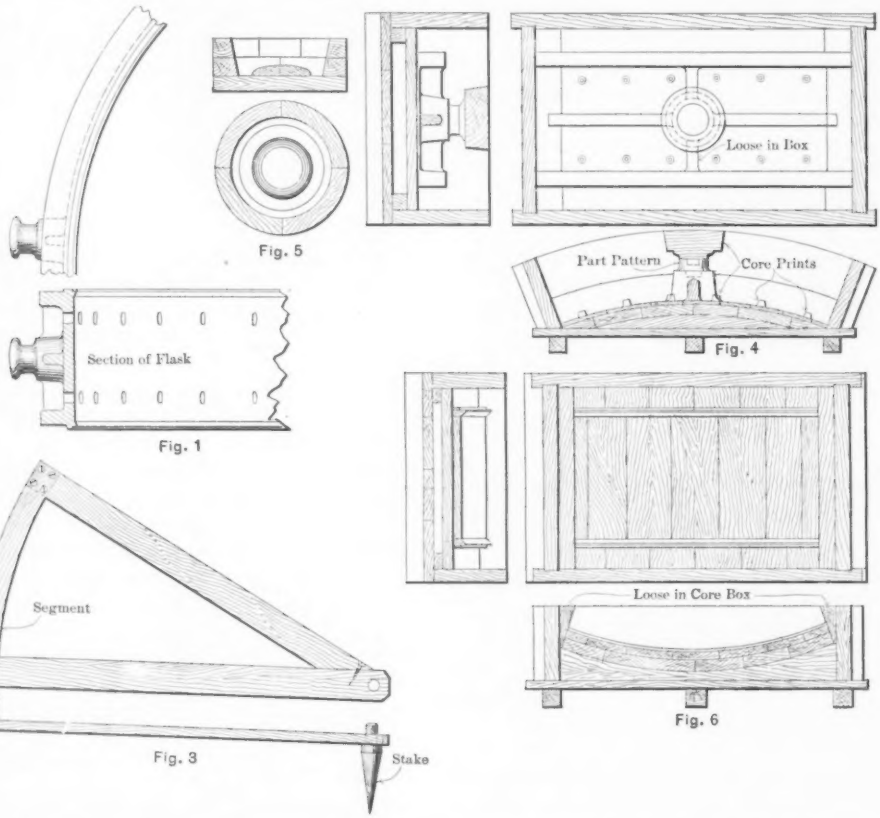
The National Scale Co., of Boston, Mass., is to build an iron foundry at the junction of East First and Second streets, So. Boston, Mass.

The National Steel Foundry Co., of New Haven, Conn., is to increase its working force, on account of a contract for castings for an underground railroad in London, England.

CASTING ROUND FLASKS IN CORES.

BY H. J. M'CASLIN.

The accompanying illustrations show one method of casting round flasks of large diamter in cores which has given very satisfactory results, and a saving in pattern expense, as well as in the floor space required for pattern storage. A plan and cross section of a portion of the required flask is shown in Fig. 1. It will be noted that there are two lines of cored bolt holes about the flask and a sand strip on the inside of the top and bottom. In most cases, four trunnions are cast on each flask, one of these being shown in Fig. 1. A cross section through one side of the assembled cores is shown in Fig. 2, illustrating the manner in which the cores are placed together. In making up the mold a hole is dug in the floor to a depth equal to the height of the cores and with the aid of straight edges a level bed is struck off. With the segment attached to and revolving about the stake as shown in Fig. 3 an offset shown at A, Fig. 2, is rammed up to assist in setting the cores. The number of separate pieces or cores is governed by the diameter of the flask. The circle formed by the offset is divided by four equidistant lines, and the centers of the four cores containing the trunnions are set to these lines. At the completion of the setting of the remaining cores, sand is banked and firmly rammed around the inside cores, as well as in the space between the outside of the cores and the wall of the hole or pit. To avoid the banking of sand around the inside of the cores, a flask of convenient diameter and height can be placed within the enclosure formed by the cores and the space between the flask and the cores rammed firmly with sand. The core box used in forming the outer cores is shown in Fig. 4. The trunnion and rib portions are loose from the box, allowing these parts to be removed when the plain cores are being made. The bolt holes are spaced off accurately, and taper prints are set to receive the separate cores for these holes. By giving the core prints ample taper, they can be rigidly attached to the box. A covering core is used in connection with this box to form part of the trunnion, this portion



of the box being parted as shown with the core print above and extending to the bottom of the box.

When the print has been withdrawn the core made in the core box shown in Fig. 5 is placed in this impression so as to close the opening and form the flange or outer end of the trunnion. The core box used in forming cores is shown in Fig. 6, and it will be noticed that loose wedge pieces are used to form the radial ends of the cores. To simplify the construction of the box and facilitate the drying of the core, the open side of the box is made flat in place of conforming to the

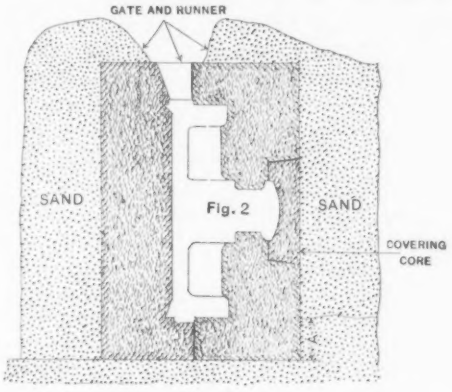


Fig. 2

diameter of the mold. Gates are filed in the tops of these cores at different points, and runners built up as shown in Fig. 2.

BELLS.

One of our friends on the staff of *The Ironmonger,* of London, has sent us a clipping from a London paper, telling of the casting of the new bells for the Rochester Cathedral. These bells were to be rung on the last Monday of November, which was St. Andrew's day. Of the eight great bells of the cathedral, which weigh altogether nearly four tons and a quarter, six have just been cast, partly with old metal from the former bells, and partly with new by Messrs. Mears & Stainbank, of the famous Whitechapel Bell Foundry. This foundry was established in 1570, in the reign of Queen Elizabeth. The other two bells, the great tenor and the mediant, were re-cast in the same foundry in 1834, and these two are almost as good as ever.

Of the six which were worn out and have just been replaced, the oldest was dated 1635, unless it be that one of the bells which bore no date was older. One of the other bells which was cast in 1635 was re-cast in 1770, at the Whitechapel foundry. Another bell bore the date of 1712, and the last one of 1683.

The foundry which has done this work has passed through the hands of a half dozen proprietors since its foundation 334 years ago. Generally the changes have come about from the succession of a foreman or manager to his master's position. In 1762, Chapman, who was foreman for Lester and Pack, went to Canterbury to cast a bell for the cathedral. Seeing a young man who took a very deep interest in the work, he said: "Come to London with me and I will teach you the business." So the youth, whose name was Mears, went and became an apprentice under Chapman. In due time Chapman became a partner and later Mears joined him. Eight generations of the family of Mears have since owned the old foundry, the name still appearing in the title of the firm.

The reporter stated that when he visited the foundry he saw the six new bells just out of the molds and being cleaned with scratch brushes. The other two bells were there also, —the tenor, to which all others must conform, and the sixth of the series, which was being tuned down by having some of the metal cut from its inner surface. The six bells which were re-cast were all poured from metal of a single melting, so as to have them uniform in composition, which would result in more uniform tone.

The article goes on to state that the metal used for a bell is three parts copper and one part tin and that this composition is almost as old as the known history of mankind, for it has been discovered that the bells of old Nineveh were made of this mixture.

Concerning the breaking or cracking of bells, he states that sometimes an enthusiastic ringer bumps the bell against the wooden stay above and thus cracks it, and sometimes the long continued falling of the clapper on one particular spot will make a crack. A bell for continuous use should be turned every generation or so in order to make the clapper fall in a new place. Clock hammers are the bells' greatest enemy, for they strike it sidewise and not in the direction of its swing, and besides they sometimes catch it as it swings past. The ringer who, to save his muscles, rings by a rope attached to the clapper, will destroy the bell in next to no time.

Silver has now and then been tried for bells, but strange to say, is almost as unmu-

sical as lead. In the Middle Ages, when a great bell was to be cast, crowds of the faithful would sometimes make sacrifices of their gold and silver ornaments and plate by casting them into the melting pot, but the only effect was to depreciate the tone of the bell.

In China and other Eastern lands, bells are rung to frighten away devils, and some of the biggest bells in the world are in Buddhist temples. Even in Christian England it was long believed that bells would dissipate storms and when they were cast there was a solemn ceremony at which they received names. This was called by the common people the baptism of the bell. Many old bells had quaint and curious inscriptions. A bell in Sherborne in Dorsetshire, dated 1652, was evidently intended chiefly as a warning in case of fire, for it was inscribed:

"Lord, quench this furious flame;
Arise, run, help put out the same."

The greatest bell in the world is that of Moscow, weighing about 190 tons, but apparently there was some accident at its birth, for there is no record of its ever having been rung. In England the greatest bells are the Great Paul, of London, made in 1881, and weighing nearly 17 tons; Big Ben, of Westminster, made in 1858, and weighing 13½ tons, and Peter of York, made in 1845, and weighing 10¾ tons. Big Ben and Great Peter were both cast by the Whitechapel foundry. Great Peter cost about $10,000 and is over 12 ft. across. When it was cast at the Whitechapel foundry it was allowed 12 days to cool before it was taken from the mold.

The above is of especial interest to Americans, on account of the great age of the foundry. In this country we rebuild and change with such rapidity that it is impossible for any foundries to grow old and hoary, and if a foundry has run through two or three generations it is a decided exception. Of course there are a few exceptions of foundries which were started in the early part of the last century, but they are few. It would be interesting to look up the history of some of these older American foundries.

The Columbus Brass Co., Columbus, O., has increased its capital stock from $75,000 to $200,000. The officers of the company are Chas. H. Lindenberg, president; Frank H. Lindenberg, vice president and general manager; Geo. W. Lindenberg, secretary, and Paul Lindenberg, treasurer.

AUTOMATIC CORE OVENS USING OIL AS FUEL.*

BY S. E. BARNES.

Natural gas is the only proper fuel for the core oven, when it can be had. But when gas can not be had, it becomes necessary to choose between coal, coke and oil. Of these three articles of fuel, coal is the least desirable for the average core oven, on account of the uncertain quality of fire to be obtained by the draft of a core oven, the time required to get a fire when wanted in a hurry, as is often the case, and the ashes which have to be cleaned out and hauled away each day. The price of coal is fully as high as any other fuel. Coke is some better than coal, as the fire to be obtained from it is sure to be good, when you get it. Coke requires less draught than coal, the result of which is a hotter oven.

But there still remains the want of fire in a hurry many times, when it is not to be had, and the handling of ashes and coke. While these two fuels have served well in the past and will continue to do so in the future, I feel certain that they must give way in time, to some extent, to a more modern and convenient fuel. By invitation of your secretary, I am here to describe to you a system for burning oil, which I consider absolutely safe, economical and convenient. In order that the points claimed for this system may be fully understood it will be necessary for me to give a brief history of my experience in burning oil.

About three years ago, the management of the shop at which I am employed, decided to do something to help the coremakers along, as they were very busy and crowded into small space, as coremakers usually are. The result was the use of oil instead of coke in two large ovens and the purchase of oil burning torches. At the time that these changes were made, the writer did not consider them of any great importance. But as we became better acquainted with the use of oil, results began to appear in the way of convenience. In many cases where it had previously been necessary to put large cores in the oven the second and third times to dry blackening and joints, the torch does this work in double-quick time, and does it well.

Large patches can be made by the use of the torch, by putting on thin layers at a time and drying each one in turn, which would re-

*Paper read before the Philadelphia Foundrymen's Association, Jan. 4, 1905.

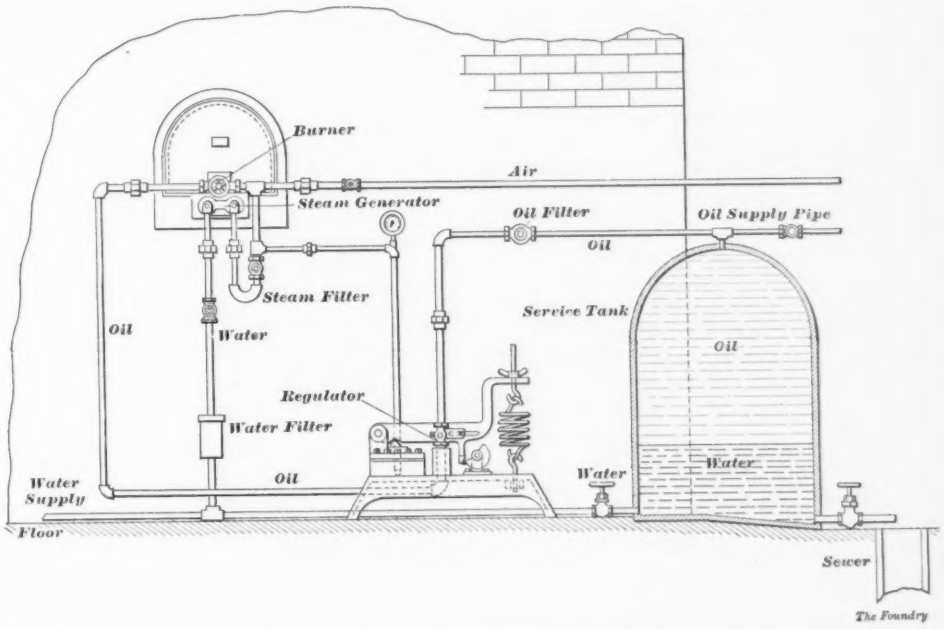
quire much more time and cost by drying in the oven. The torch is also useful to skin-dry molds, thaw the ice and snow from flasks and boards in quick time, and for light and heat in cases of emergency.

At the time we started to use the oil in the ovens the machine shop was very busy, requiring the engine and air compressor to run all day and night, thus furnishing air for the burners at any time except Sunday. When the machine shop became slack, and they ran the engine only in the day time, the small air compressor that was run by steam in the night for the ovens did not furnish enough air; and besides it was always getting out of repair, as well as consuming about as much coal in the night as would be required to run the ovens with coke, not to mention the cost of oil.

It soon dawned upon me that these conditions could not continue long, and being anxious to continue using the oil, I decided to try another way to burn it. Having read of oil being burned to advantage with steam as the blowing force, I tried it in this way. I had often observed the rapidity with which steam is generated by throwing a small amount of water on a piece of hot iron, or into a hot pipe. I acted on this principle and made a cast iron return pipe about three feet long, with a 7/8 in. hole from one end to the other and back and placed it in the fireplace, leaving the open end flush with the outside wall of the furnace. I then connected the city water to one end of the 7/8 in. opening and the other end to the air or steam end of the burner, and turned on the air for a few minutes to heat the generator, when the air was turned off again.

Now to get the steam by the new system, turn on the water by means of a needle point valve, which allows a very small stream of water to enter the generator; thus instantly generating very dry, hot steam at any pressure that may be required by a slight turn of the valve either way.

Thus we have the steam to run the fire continuously; but when there is no air there is nothing to feed the oil to the burner, as the steam is only used to spray the oil into the furnace after both have been brought together by different pressures. The pressure for the oil is obtained by simply connecting the city water to the bottom of the oil tank, thus forcing the oil, which is lighter than water, out through the top of the tank to the burner.



This system was used for a time, bringing the cost of fuel down to the actual cost of the oil. But I soon discovered that to complete this system, it would be necessary to regulate the oil, so that it would flow in proportion to the steam pressure, which may range from 1 lb. to 40 lb., as needed for the amount of heat required. An old damper regulator was taken from the boiler room and

remodeled so that it opened and closed the oil valve automatically, with the rise and fall of the steam pressure. This completed the most perfect and economical arrangement for burning fuel oil.

This way of burning oil is the safest, because oil is dangerous only when it is thrown into a hot furnace without sufficient steam or air to spray it properly; then it will instantly explode with some force.

The oil regulating valve prevents the above conditions, because it is impossible to get any oil through the burner until after the steam has been turned on, and then only in exact proportion to the steam pressure. Should the steam pressure, by any accident or otherwise, cease, the oil valve will be closed at the same time, and locked so that it can not be opened again, should the steam pressure return without the aid of the operator.

This system is the simplest, requiring only one valve to operate, start, raise or lower it. This is the water valve, by opening which steam is generated instantly, the steam blowing through the burners and the pressure opening the oil valve, all other valves being secondary and precautionary. The system is the cheapest, because it is maintained only by a very small amount of city water or any other water pressure. The whole cost for this oil for core ovens, two torches and large Babbitt's kettle, which is used almost continuously during the day, is just equal to the cost of coke for the core ovens. It is the most convenient system, because a fire can be had at any time, Sunday, Monday, night or day. There is one thing that is not quite as perfect as I think it might be, and that is the generator. It will only last about two months, when it has to be replaced. But the job is small.

I have done it many times with the aid of one helper in half an hour. But I think by the use of different metal, and some protection from the blaze of the fire, the generator can be made to last much longer.

The last thing I have to mention, but not the least, is the filter. The water passes through a fine gravel filter, to prevent the rust and dirt of any kind from stopping the flow through the small needle valve. This filter is so connected with valves at top and bottom that the water can be run through it backward, cleaning it out as often as may be required. The oil filter is an ordinary check valve with screw cap, the valve of which is replaced by a perforated plug screwed into the valve seat. This can be cleaned out at any time by removing the cap, about one minute's work. This filter will catch all pipe scales or other dirt that would be large enough to interfere with the oil valve or burner. The air filter is the same as the oil filter, and its purpose is the same.

Discussion.

The method explained in the paper which has developed into a very successful core oven, was devised entirely by Mr. Barnes and is in practical use. In the discussion of the paper the following points among others were brought out:

Q. What size are the pipes?

A. Half inch; you can have them larger if you want. Various sizes have been used, simply as a matter of convenience in erecting at the time.

Q. How much oil will the tank hold?

A. About ninety gallons. We burn just about eighty or eighty-five every day.

Q. What is the size of the oven?

A. We have two, about 9 x 16 x 12 ft. high. Both are the same size.

Q. Is it crude oil you use?

A. Crude oil at 4 cents a gallon. We burn less than 100 gallons a day, including everything. It amounts to about $4. We average about three or four tons of sand in one oven over night. The oil used covers everything—kettle and torches.

Q. What method do you use to light the oil?

A. A piece of paper or anything of that kind. There is only a small flue, 8 x 8, and sometimes a little smoke is created but not any more than by using wood in starting coke fires.

Q. How long has it been in use?

A. I have been burning oil about three years, and with the steam system for about 18 months. I have only had the regulating valve about five or six months. The regulator is the proper thing to have on any oil burner. No matter how much the pressure ranges you can get enough oil, according to the amount of steam or air pressure. We use a three deck car and put large cores on the top, medium size in the middle and small at the bottom.

Q. Do you have oil in the small ovens?

A. No, because there is a certain amount of small coke waste that they wish to burn.

Q. What sort of burner do you use?

A. An ordinary burner, furnished by Gilbert Parker of Springfield.

Q. Does the steam pressure vary?

A. It keeps very steady.

Q. You depend on the water valve to regulate the fire?

A. Yes; and to put the fire out you close the water valve. After running two or three hours it is hotter than when it was first started.

Q. Have you ever had any explosions?

A. I had my hair singed a couple of times before I got thoroughly acquainted with it, but that is now impossible. You cannot get any oil in the furnace.

Q. Do you ever run the generator to destruction?

A. There is nothing to it. You lose the steam pressure and the oil shuts off.

Q. How long does the generator last?

A. Two months. You can put one in in half an hour. It burns four gallons an hour or at the rate of sixteen cents an hour.

Q. Did I understand you to say that coke costs 50 per cent more than oil, in addition to the labor and more trouble?

A. Probably not quite so bad as that, but coke costs $6.25 a ton. We get more fire out of the oil than we do out of the coke and there is less labor required.

MELTING SCRAP ALUMINUM.

BY HARRY MALONE.

I remember once hearing a story about a boy who said he was not going to school one day and some one asked him: "What is the matter? Don't you know your lesson?" He said: "That's just the point. I know my lesson. It's when I don't know my lesson that I want to go for an explanation." I am afraid that the writer is somewhat in the fix of the aforesaid boy on the days that he went to school. In other words, he has gotten far enough into the problem to come to the conclusion that he does not know much about it and hence he wants to tell what he does know in the hope that some one else will give the rest of the solution.

There is a lot of scrap aluminum of various classes on the market. Some of it is in the form of borings and turnings, and some in the form of sheet aluminum scrap from which punchings have been cut. It is all good high-grade metal, but when it comes out of the melting pot something is wrong with it. If an attempt is made to press or roll the casting it will be sure to crack. Now the following are facts which we know. It is not difficult to melt scrap brass and produce a casting which can be bent, pressed or rolled as well as the original metal, but we also know that if the attempt is made to take the best kind of sheet copper rolled from good lake metal and melt the scrap in crucibles, the resulting castings cannot be bent or rolled without more or less of a tendency to crack. In the case of the copper, we know that the difficulty arises from the fact that copper oxidizes very readily and that the red oxide of copper is absorbed by the metal without changing its color or appearance in any way, but that when the metal is worked the oxide makes it brittle, just as the presence of so much sand in its composition would. If the above mentioned scrap copper be melted with a liberal charcoal covering somewhat better results are usually obtained. If, in addition to the charcoal covering, the metal be poled with a green pole, that is, if a green pole or stick be introduced into the molten metal, which is well covered with charcoal, and used for stirring the metal, it will often reduce the oxide and result in pure metal. The addition of a little phosphor copper will produce the same result, on account of the fact that the phosphorus is oxidized and removes the oxide from the metal.

Now with the above facts in mind, if we turn to the aluminum problem we are confronted with the following conditions. The copper oxide was lighter than copper, but was soluble in copper. When this oxide was reduced with phosphorus, it formed a dross which could easily be skimmed off. In the case of aluminum, we are not so fortunate, as the specific gravity of aluminum oxide is nearly 3.9, while that of aluminum is only 2.5. It will be seen, therefore, that the aluminum oxide would settle into the metal as fast as it was formed and we would expect it to go to the bottom so that we could pour off the metal and leave the oxide in place of skimming the oxide and leaving the metal, but this is another case where the metal does not do as it ought to do, for the oxide becomes entrapped in the metal and will go neither to the top nor to the bottom. The color of the oxide, as in the case of the copper oxide, is such that it does not show in the resulting castings, but if we attempt to roll or form the castings, the metal will break.

We know that aluminum oxide is not reduced by charcoal, and hence a covering of charcoal will have no effect whatever on the cru-

cible, except that it may maintain a layer of carbon dioxide gas over the surface of the aluminum and thus exclude the air. In other words, it protects, but does not reduce. The aluminum sheet or scrap is so thin and light that no ordinary amount of flux will protect it from the air. A small amount of scrap can be disposed of by plunging it in a crucible of melted metal just as it comes from the furnace, but beyond this the writer knows nothing as to how to get rid of this scrap, and we would like to know if some one cannot go ahead with this story and bring it to a successful finish.

AN OLD MAN'S KICK.

What is the matter with the foundry business? I see the poets are now butting in. It seems to me these fellows have missed their vocation. The question which exists between the chemist and the foundry foreman, as to which shall be the whole thing in the foundry, it seems is a hard case of the green bug on both sides. I will pass a few remarks in reference to both and a few other things which the writer has observed in his travels, trying to get what the chemist calls salary and F. F. calls wages. Now, I have seen some of the worst iron possible produced by some of the best foundry men in the country, both from furnace and cupola, and I have been in another neck of woods, where two first class chemists had full charge of furnace and pot, with the help of a furnace man at $30 per week and the iron produced was a great deal worse. So you see there is no use for the kettle to call the pot black. A great many foundry foremen are mad because they don't understand C-CC and high and low S and P. In other words they are not chemists, and if they have been in the foundry twenty-five or thirty years they are too blamed old to learn and the chemist is just as mad as the F. Foreman. So I will say to the young man going in the foundry, get a gait on and learn both before the film under your hat gets too thick, and you will get the salary, when both the other fellows are writing poetry, at a penny a verse.

If the foundry foreman will only broaden his gauge and get the idea out of his head that he must go out the back door when the chemist comes in the front, he will rest better at night, and be better able the next a. m. to produce castings at a profit to his employer, and a credit to himself. I will say to you foundry foremen, be loyal to your employer, honest with the men under your charge, and don't forget to be always pleasant and nice to the apprentice boys, for you know what their parents told you when they asked to have them taken in the foundry to learn the trade: That they were the only good boys in the world. Of course they are all good boys for the first sixty hours they reside in the foundry, and after that they change from mother's pet to an inventive genius of deviltry. But we like the boys for all that.

One word with the apprentice boys. Try and keep your mind on your work; do as your foreman advises you to do. If he don't know as much as you do, he is older than you, and you should respect old age, for you know the old man has to get out soon, for the young chemist wants the easy chair; and, boy, don't stop work and wait for the whistle at 11:45 for she won't toot until 12 noon. Do your best while at your trade, for you have a long, hard road to travel if you want to get as good as the best of them who pound sand.

My brothers of the craft, right here is the chestnut burr under the horse's tail which has caused the kick in the factory where they make iron castings and cast iron scrap. The chemist makes his by using one to ten, the other fellow makes his any old way. We have with us now, in the foundry, the young man of affairs, of course not in every foundry, but in some, and he is there all right. He is the young man who fell heir to his father's foundry, stock and fixtures, reputation and million or so, which the old man made when he was running the foundry fifty years ago, and up the last few years. Some of the old man's early day castings are doing business at the old stand yet. Now, Mr. Chemist, don't jump on the grand old man of the foundry. The young man of affairs takes a stroll through his foundry and his chemist is standing to meet him with one foot on a very nice casting made under the supervision of the F. Foreman and the chemist gets a nice bunch of flowers after their chat. The heir to the foundry strolls on a little farther and sees a rough casting and perhaps bad. iron mix by chemist, and casting made under the supervision of same foreman. The chemist has left the earth, he don't live down here only at such times as above. The F. F. gets ripped up the back and a bunch of garlic over the long distance phone from the young man of affairs.

Now the old man that used to run the foundry and does yet, and will for some time to come, comes down and has it out most any place and tells you what is what; he gives you neither flowers nor garlic but talks good common sense. The chemist will tell you that a few points of the different elements in iron will make a vast difference in the quality of your castings. I will give you an experience of mine with a few of them. We melt four or five hundred tons per month and get most of our iron from one concern. Two carloads did not come up to standard, did not find it out by analysis, only by horse sense, so sent in our kick. The furnace people sent analysis of the two cars to prove that it could not be the fault of iron, of course not. Well, the writer took four pigs haphazard and sent drillings from same to different chemists, the result was that none agreed with furnace report and differed as much as 20 to 30 points with each other in the different elements, so that the result desired proved useless, and led the writer to believe that some chemists must lie—and some don't know their business any better than the F. F. does his and some are too lazy to go through pow wow. Cost of analysis, $15.00; information gained from chemists, *none*. Two car loads used by using more or less strong No. 2, a little scrap (remelt) and a few pounds of other iron on each charge. Result, good tough casting machined readily. Transverse test, 1 in. sq. bar 2.760 common rule measure, 1⅛ in. run 2.670. The above has made me consider whether it would be advisable to mix iron by long distance phone. Some of the chemists should tell the old men of the foundry some things they have done for the foundry. The writer knows of a foundry the chemists run to a standstill. There are a couple of old foundrymen getting a move on it now.

If the publishers will permit me at some future time I will state my reasons for thinking why the chemist should be at the furnace and give the foundrymen an honest count and also some things in reference to cupola practice and a few other things seen while passing through the foundry. An old man's kick, but not the last.

Messrs. Albert and Robert Fitzgerald, of Albany, N. Y., are preparing to open a brass foundry at 19-23 Lawrence street, Albany, N. Y.

SOUVENIR NUMBER THE BLACKSMITH AND WHEELWRIGHT.

This special number has been gotten out to commemorate the 25th anniversary of the starting of the *Blacksmith and Wheelwright*. The paper with its regular cover has been enclosed in a special souvenir cover, with a suitable picture on the front. This number is gotten up very neatly indeed, one novel feature being that they have printed the advertisements of the firm which have advertised in the paper for ten years or over on colored paper and called them their roll of honor. The reading pages of the number contain especially interesting matter. One of the features is a page devoted to an illustrated rendering of the poem, "The Village Blacksmith." We certainly wish to congratulate this paper on its success in the past and on its souvenir number, and wish it a long and successful career in the future.

FOAMING SLAG.

A very interesting case of foaming slag has recently been brought up by one of the subscribers of *The Foundry*. After melting about 7½ tons of iron, the slag hole of the cupola was opened, and remained open during the balance of the heat. There was about one-half as much slag as usual flowed out and after that, although the slag hole was open for the balance of the heat, no more slag was run out but the slag remained in the cupola and foamed up through the charge clear to the charging door. All of the iron required for the balance of the heat had been charged and the charging door closed. The next morning, when they came to open the charging door, they found the cracks about the doors and about the door frame full of slag, and that the portion of the door frame which extended beyond the edge of the brick work was all burned off. Also one course of brick at the melting zone was burned of. The lining was a new one, this being the third heat. The iron mixture was the one that had been used for a week without giving any bad results. The writer has had experience with a number of different cupolas, and this is the worst case of foaming slag that he ever saw, and he would like to know if some one can enlighten him on the subject and explain it in any way.

A SUBSCRIBER.

The Bellefontaine Foundry & Machine Co., of Bellefontaine, O., has increased its capital from $50,000 to $75,000.

MAKING A SPIRAL DRUM IN LOAM.

BY JOSEPH HORNER.

I propose in this article to give a detailed description of the molding of a large spiral drum, or screw barrel, for a powerful Titan crane. It is a class of job which is hardly ever done outside the crane shops, and is an excellent example of heavy loam molding.

Figs. 1 and 2 show the casting of the barrel complete, Fig. 1, to the right, being a half external elevation, the view to the left a half

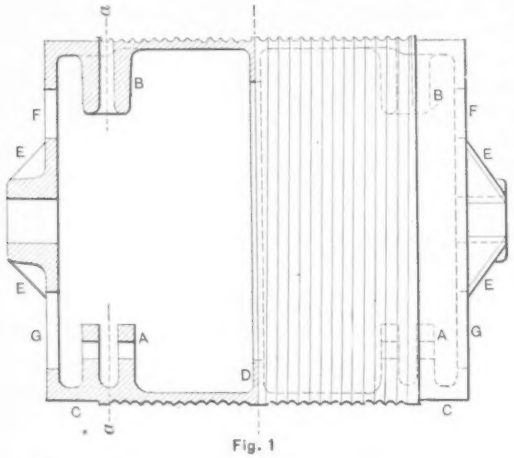


Fig. 1

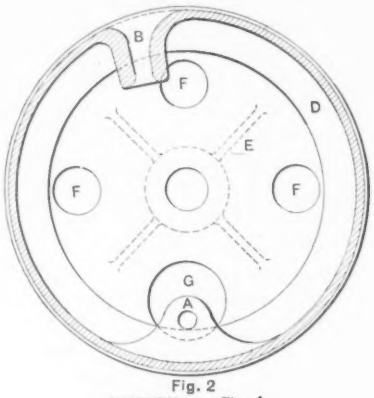


Fig. 2
SECTION *a-a* Fig. 1

longitudinal section. Fig. 2 is a transverse section taken through the plane a-a in Fig. 1.

The barrel has two single-threaded screw grooves, right and left handed, respectively. In these lie two divergent wire ropes, for lifting the load in unison, the ropes passing from the barrel to a suitable snatch block. They are attached to lugs A cast within the barrel,

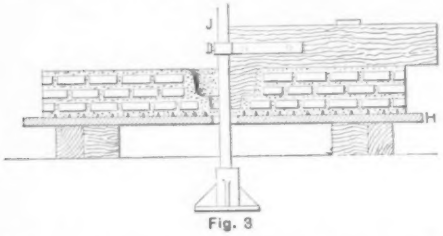


Fig. 3

Figs. 1 and 2. An eye splice is made at each rope's end, which is slipped between the double lugs A A and held with a pin fitting in the holes in the lugs. Each rope passes thence through its hole in the lugs B opposite, and so out into its groove.

The toothed wheels by which the barrel is revolved are keyed upon the plain portions C C. An annular rib or ring D is cast inside the drum midway in the length, to stiffen the central portion of the body. Ribs are cast at E from the shaft bosses to the plated ends, to stiffen and support both. Holes are cast at F to act partly as supports to the central main core, partly to carry off the air from that core. Larger holes are cast at G to permit the pins to be passed through to anchor the wire ropes in A, and they are big enough to allow free access for the workman's arm, and they also help to support the core.

A job of this kind is necessarily struck vertically, that is on end, with the shaft bosses above and below. The first portion of the mold to be made therefore is that which forms the boss and flat face at one end. This, like all the main portions of a loam mold, is built upon a massive cast iron plate, made in open sand, and rigid enough to stand hoisting about with its load of bricks, without springing or buckling out of truth. The springing of a light plate would cause the mold to crack, and risk a waster casting.

This plate, shown at H. Fig. 3, is about 3 inches thick, large enough to carry the bricks, and is furnished with lugs to be lifted and lowered by. Upon it the bottom part of the mold, the skeleton of which in this case consists of three layers of bricks, is built. The figure shows the bottom of the mold as it appears on completion. First, the plate H is leveled on timber blocking on the floor, three blocks to the circle, the spindle J is stepped vertically in its socket, with a plumb level, and a plain striking board is fastened to it, as shown, by means of the strap. Being planed parallel on top and bottom edges its truth is tested with a spirit level. Then the plate is daubed over with loam a little deeper than the prods, and the first course of bricks bedded down on it. Spaces are left, being filled with

fine sifted ashes mixed with the loam, for the exit of air. The two following courses are next laid on, also with joints well open, and filled in with loam and fine ashes similarly. Clear spaces are left for the striking of the central boss, and also for the bedding in of the four ribs E, Figs. 1 and 2, which are also

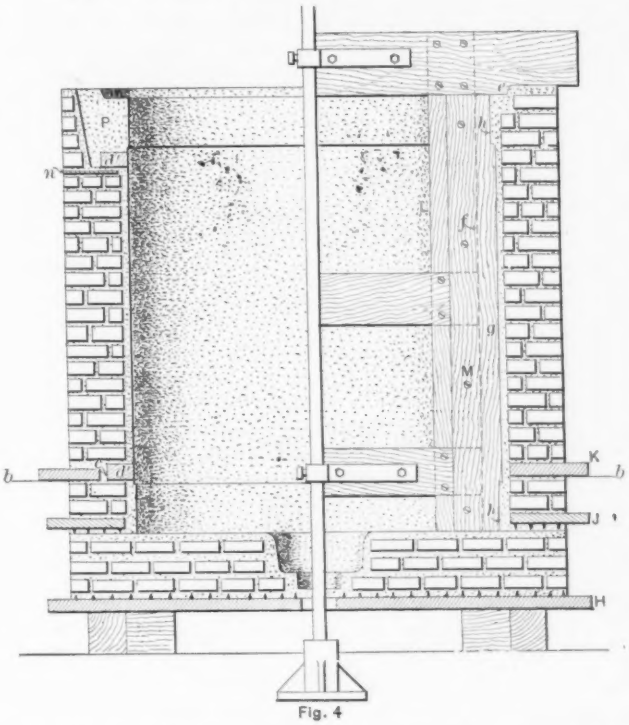


Fig. 4

well laid in thin loam, 1½ or 2 inches of the latter between the pattern ribs, and the nearest bricks. These do not appear in Fig. 3, the plane of the view being taken at a position about midway with the plane of the ribs.

After the mold is roughed up, the bricks all laid, and coarse loam swept over the whole surface, it is left for a few hours to stiffen. Then the final coat of loam, thin, and passed through a fine sieve, is swept over smoothly with the board shown in Fig. 3. Finally the entire bottom is lifted and put into the core stove to dry and hardened preparatory to the next stage, shown in Fig. 4.

On this bottom, when dried, a ring plate J is now laid, with parting sand strewn between the bottom of the plate and the top face of the mold just finished. This plate has to carry two courses of bricks to give a joint face b-b, Fig. 4, coinciding with the bottom of a print that has to carry the core for making the opening B, Figs. 1 and 2, through which the wire rope passes to the outside of the barrel. The plate J has to be turned over once, being laid first with its lower prodded face uppermost, to have a coat of loam swept over. When this is dried, the plate is turned over into the position seen in Fig. 4, to receive the bricks bedded in coarse loam. On the second course, a coat of fine loam is strickled off smoothly on the joint b-b, and dried. Upon this face is then laid a third plate K, which has to carry the whole superstructure up to the cope. This plate is shown in plan in Fig. 5. A recess is cast out of it at c, and the metal thickened up around that. The recess is provided to afford space in which to lay the print d, that has to carry the core for B in Figs. 1 and 2. The reason why it is necessary to break the continuity of the bricks by the plate K at the joint b is that the mold must be divided in that plane to permit of the insertion of the core for B.

The plate K having been thus laid upon the joint face, built up to the plane b, parting sand intervening, numerous courses of bricks are built upon it, as shown in Fig. 4. Before commencing to build, the striking board L is fixed in position on the striking bar. This

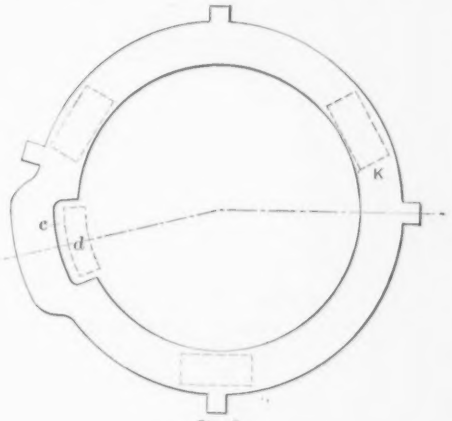


Fig. 5

board is framed together with half lapped joints. Two of the horizontals are secured by

means of strips to the central bar; the middle horizontal serves only as a strut or distance piece, abutting against the bar to resist the tendency of the board to yield inwards under the pressure of the loam.

The edge e of the board forms the checked joint for fitting the cope concentrically by. The edge f, which is the actual edge of the board L, forms no part of the mold. It is cut to a radius of about an inch less than that of the finished mold. So that the vertical

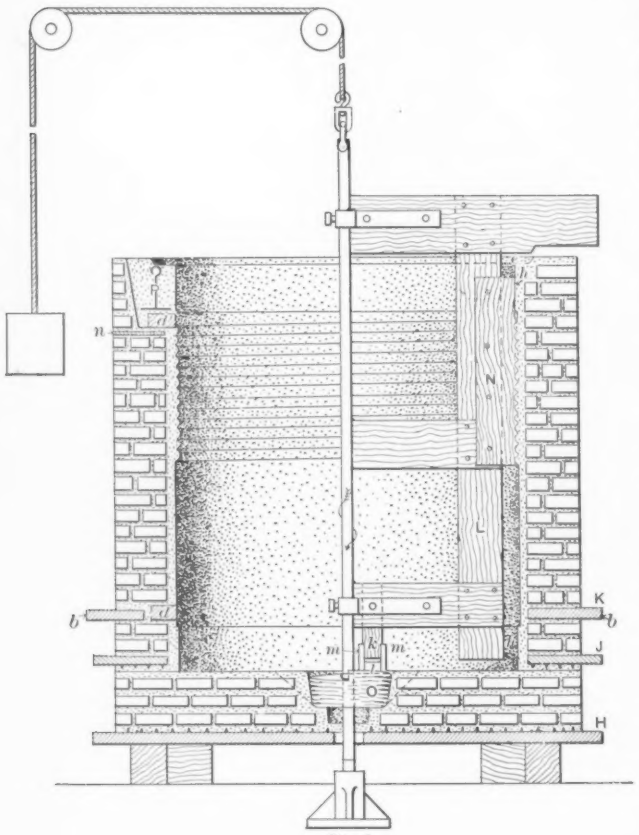


Fig. 6

member of L forms simply a means of attachment for the actual boards by which the spirals are struck, as follows.

In the first place, a board M with one straight edge chamfered, is screwed upon L. The edge g of M comes within ⅛ or 3-16 in. of the bottom edges of the grooves in Fig. 1. With this board screwed on thus, the whole of the interior of the mold from the bottom to the cope joint is roughed up; that is, courses of bricks are built one above another with overlapping joints, having coarse loam between vertical and horizontal joints, no ashes, however, being necessary in this portion of the mold, and the inner faces are swept with coarse loam, and struck roughly circular, but not smoothed much with the edge g of the board M. Only the upper face e of the checked portion of the mold is finished with fine loam at this stage, and the belts h, h, corresponding with the smooth belts C, C, in Fig. 1 for the bores of the wheels. The mold is then allowed to stand to become partly set for the space of a few hours. In the course of this stage of the work certain bricks have to be omitted, but it will be better to consider this presently in connection with Fig. 6.

The board M is next removed, and preparation made for striking the screw thread that comes uppermost in the mold. If the lower screw were struck first, and the upper one afterwards, the loam would tumble down from the latter, and mess up the bottom screw. Striking the upper one first, this trouble is avoided.

The board that strikes the top screw is shown at N in Fig. 6 attached to the board L, at the exact radius required to make the diameter of the thread right. The extreme portion of the board stands ⅛ or 3-16 in. within the roughed up surface of the loam struck by the edge g of the board M in Fig. 4.

To strike the screw, a special apparatus has to be rigged up, comprising a templet or former screw, O, enlarged in Fig. 7, cut to the pitch of the screw that has to be struck. It is made from a solid piece of pitch-pine, or of red deal. The diameter of the outside is made only as a matter of convenience to fit into the boss struck in the bottom of the mold by the board in Fig. 3. In cases where there is no boss, or only a very shallow one, or one small in diameter, a special recess is struck large enough to take the former screw, and is filled up afterwards, or made good to the proper dimensions by bedding in a suitable pat-

tern boss. The former screw should never be less than 10 in., and is better if 12 or 14 in. in diameter.

To the bottom of the board L, in Fig. 6, a piece of wood k carrying a small roller l (compare with Fig. 7) is bolted. The roller runs between two plates m, m, screwed to the sides of k, holes being drilled in the plates to receive small journals turned on the roller ends. As the molder draws the board round, the roller runs up the incline of the former, and the board strikes the upper screw. But the

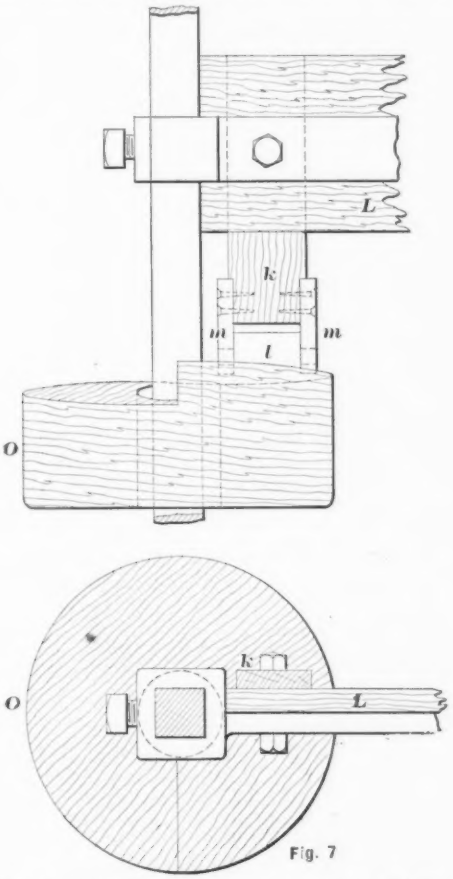


Fig. 7

board and bar are heavy, and the friction of the small roller is considerable. A counterbalance weight, Fig. 6, is therefore attached to the top of the bar, at the top, with a shackle, and swivel, from which a rope passes upwards, and over light pulleys having bearings on a beam overhead. Without this counterweight the pulling round of the board would be a work of considerable difficulty.

The loam for the spiral is first thrown against and daubed on and pressed against the roughed-up surface with the hands, swabbing being first done, and the board is swept round until the rough semblance of a screw is obtained. In places where the loam is deficient in quantity, it is made good with the hands, until after about half a dozen good sweepings good outlines are obtained. At the termination of each revolution the board is dropped down from the highest to the lowest position of the screw O in readiness to commence another rotation. The swept up screw when

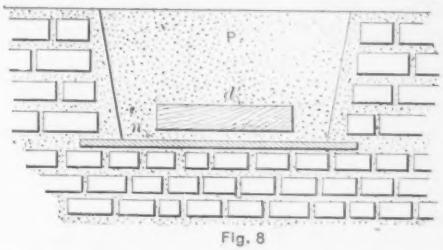


Fig. 8

brought well into shape is allowed to remain for about an hour to stiffen, and then about half a dozen final sweepings round the board using fine loam, complete the outlines.

Since the board is dropped on the templet screw at the termination of each revolution, the thread is destroyed in the loam at that location, in a width exactly equal to the thickness of the board. This space is doubled with loam on the completion of the sweeping up, and when dried is filled to the screw shape.

But before this stage is reached the provision will have been made, as mentioned in connection with Fig. 4, for carrying the top print d' for the recess B, corresponding with

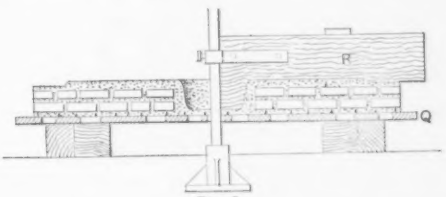


Fig. 9

the similar one d below, and which we will now consider.

At P in Figs. 6 and 8 there is shown a recess with beveled edges, formed in the bricks, and a plate n is inserted in the recess. Upon this plate the top print d', corresponding with the bottom print d, is bedded in loam, in its appropriate position. This does away with the necessity for a large plate like that, K, used in the bottom. The top print is set vertically over the bottom one with a straightedge and spirit level. When the print is set the loam can be swept up and finished.

After the top spiral has been struck, the board N is removed and screwed to the lower portion of the board. Another templet screw of the other hand is substituted for O, and the bottom spiral is struck up in the same manner as the first. The mold is then dried, either in a stove or by means of devils or open cages containing coke, lowered down within the mold. In the meantime other portions of the mold will be going on.

The cope is carried on the plate Q, Fig. 9, prodded all over to assist in holding the loam. cast in it. The bricks are loamed over with a board R attached to the striking bar. The finished cope, when dried, fits by its check into the checked portion of the top part of the mold, shown at Fig. 6, and must consequently be concentric with it.

We now consider the main or central core for the drum. This is built upon a plate S, Fig. 10, the outside diameter being made a little smaller than that of the core, and beveled round the edge. The diameter of the central hole must be large enough to admit the

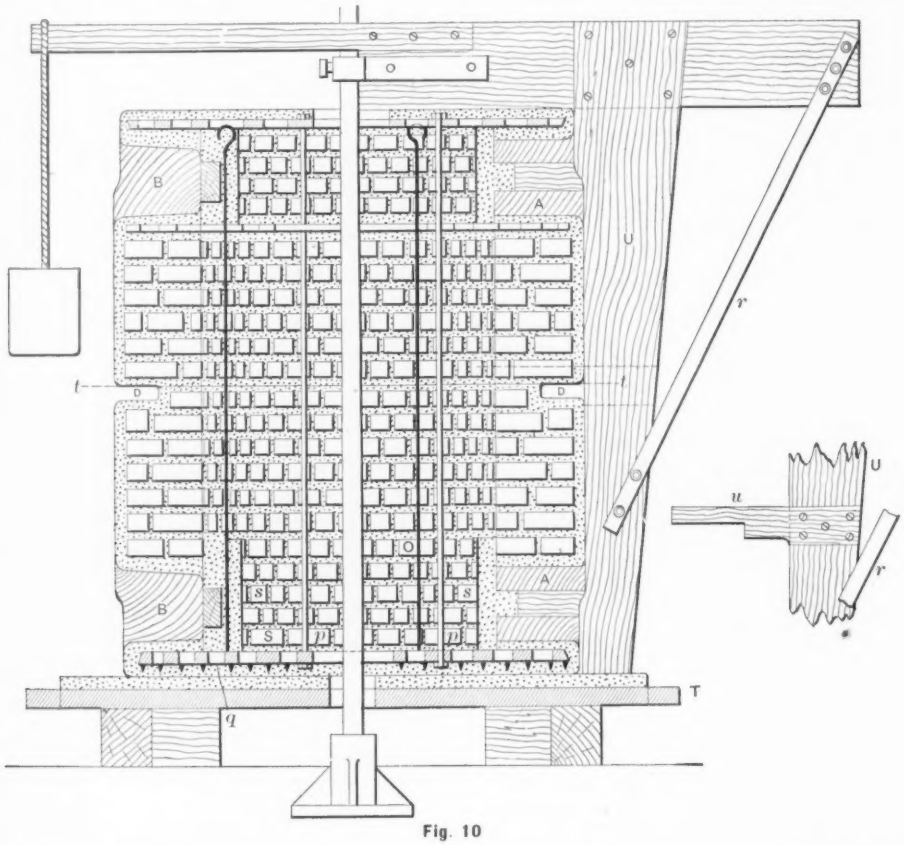


Fig. 10

In the case of a perfectly level surface, or even one that is not much out of level, as say, slightly curved, or recessed, nothing more than loam would be requisite in any plate that has to be turned over. But in this case as there is a rather deep top boss, the necessary thickness has to be made by bricking up, similarly to the bottom. To prevent the bricks from tumbling off when the plate is turned over into position, a number of the bricks, at intervals, are secured with stout binding wire to the plate, the wire being passed round the bricks (this is not shown), and through numerous holes shaft core. Eyes are cast at o (compare with Fig. 12) to lift the plate by, and holes at p for bolting the top and bottom portions of the core together by—compare with the plan view of the plate, shown separately in Fig. 11.

The bottom of the plate is first loamed over and dried, to form a joint face later on with the bottom of the mold. When dry it is placed upon any level bed, usually a loamed plate T, as shown in Fig. 10, and the bricking up commenced on the top face.

The striking board U, Fig. 10, is strutted at

r, and an overhanging end, screwed on, takes a counterweight to relieve the weight of the board itself.

Before commencing work, note must be made that the lugs A, B, in Figs. 1 and 2, have to be built into the core. The position of these are indicated by the letters A and B in the plan view, Fig. 11, which shows the pattern lugs imbedded in place. A kind of cage of vertical bars s is cast in the plate, standing up around each of these spaces, to help support the loam there.

cooled down to the black heat. The bricks are built up similarly to those in the outer mold. Wider spaces filled with fine sifted ashes are left here and there. Through these the vents escape into the central hollow portion of the core, which is left open and destitute of bricks.

The board U is carried straight up to the full depth of the core. But the core itself is made in two portions, divided on the line t-t, corresponding with one face of the internal rib D, Fig. 1. This rib and the joint face are

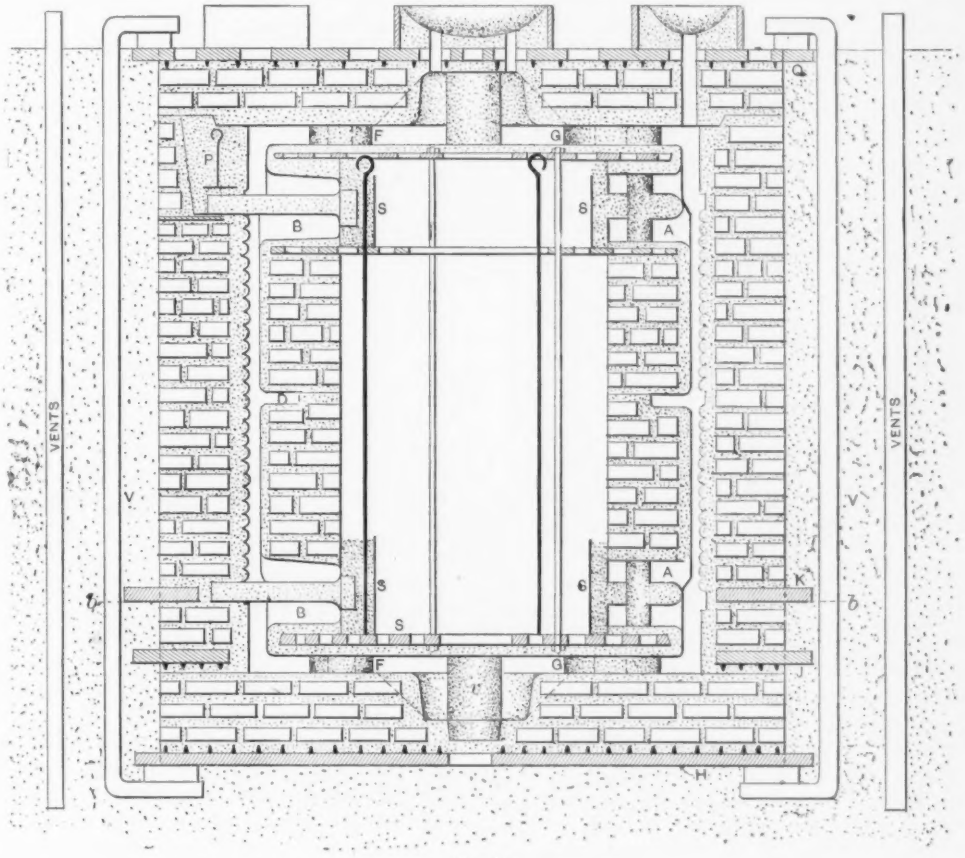


Fig. 12

As metal will shrink around a core, this shrinking involves the risk of a fractured casting, unless provision is made to permit of such contraction. As hard bricks will not yield, loam ones must therefore be inserted all down the core on three or four sections. These become crushed by the shrinkage, and allow the core to yield inwards. But in addition to this provision it is usual and necessary to break up the core by dislodging the bricks with the crowbars before the casting has

struck with a suitable tongue piece u, screwed upon the board, indicated by dotted lines in position in Fig. 10, and separately to the right of that figure. After the rib D and joint face t-t are swept, the piece u is unscrewed from the board. When the core is finished thus far it is lifted by the eyes o, and put into the drying stove.

On removal from the latter the portion D is filled up with ordinary sand level with t-t, and the remainder of the core is built up similarly

to the lower portion. The lugs A and B are bedded in the loam at their proper height, and plumb over the corresponding bottom lugs, being checked in the same manner as the prints were in Fig. 8. The core is again put in the stove; when dry the lugs are withdrawn, the core scoured over with glasspaper and is then ready for trying in the mold.

A great deal of care is required in putting the various parts of the mold together, and in making due provision for pouring and venting. The mold is put in a casting pit, so that its top is brought about on a level with the foundry floor. First, then, the lowermost plate H, Fig. 12, is well bedded on the bottom of the pit. The middle core, Fig. 10, is then put in, and centered, being supported on cores F and

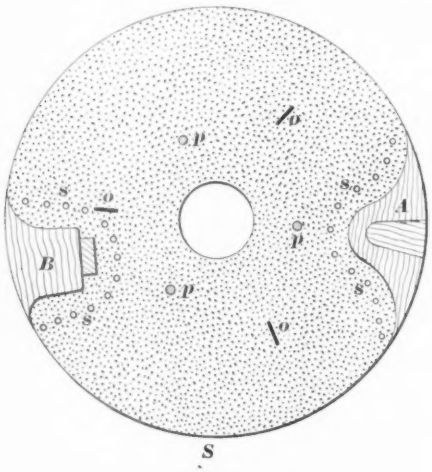


Fig. 11

G, which form the holes F and G in Figs. 1 and 2, and the core v for the central shaft is also inserted. The latter, Fig. 12, v, fits in the print impression struck by the board in Fig. 3. The others, F, G, are simply set in by measurements, being of the same thickness as the metal in the end of the barrel.

Next the portion of the mold carried by plate J is lowered, and the cores A and B are placed in position, followed by the upper portion of the mold carried on plate K from the joint b-b, then the upper cores A and B are inserted, and the filling-in cod-piece P put back into place. The details of this work call for a little explanation.

The cores A and B are made from boxes shown in Figs. 13 and 14, respectively. It will be seen in Fig. 12 that the cores A, B, have to be inserted in the print impressions in the main central core before the outer ring is lowered into position, in the case of three of the cores, the fourth being covered by the cod-piece P. And unless the outside were jointed at b-b the lower core B could not be inserted and supported in print impressions at each end. This is an important detail, because if the core were supported at one end only thus, and with chaplets elsewhere, there might be risk of displacement, or of blowing. There is no difficulty of this kind with the cores A A, which fill up and are steadied in their pocket print impressions, hence these are inserted in the main core without requiring any further support.

Lastly, the cope, Fig. 9, is lowered down

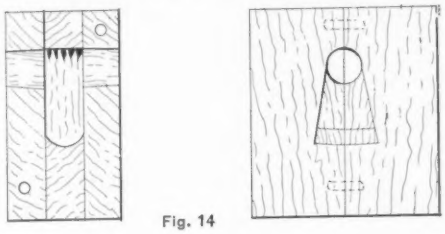


Fig. 14

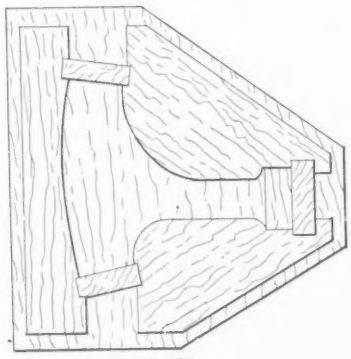


Fig. 13

and the pouring basin and runners made. But there are many points to be attended to during these operations. Thus, after the central core is put in position, the whole of the interior which was left destitute of bricks is filled with cinders. This is done to prevent an explosion of gas, since it must be remembered that the air from the core all strikes inward between the joints of the bricks. If there were no cinders in the central portion, this gas would accumulate in a large body, and mingling with oxygen would ignite and cause a blow up. Being diffused, however, among the cinders it escapes and does not ignite until it reaches the vent holes.

Then, further, there is enormous liquid pressure in a deep mold, and this necessitates se-

cure bolting of the top and bottom parts together. Bolts p pass from the top to the bottom plates in the core, and clamps b pass from the cope plate Q to the bottom plate H, being slipped over the lugs cast upon the plates and wedged.

To resist pressure tending to bulge the outer mold, the space between the walls of the pit and the bricks of the outer mold is filled up with floor sand shoveled in, and pressed down hard with hand rammers. If the pit is very much larger than the mold it is usual to form a temporary wall round the mold with a series of iron rings, and ram sand between the mold and the rings.

HIGH SILICON PIG IRON.

There has been considerable discussion in *The Foundry* at different times concerning the composition of various irons and the statement has been made repeatedly that a chemical analysis sometimes fails to reveal all of the properties of the iron. For instance, it is stated that an iron made from one of the southern ores which may apparently be identical in composition with the northern iron will frequently have very different physical properties, especially in regard to its chilling properties. It is probable that these qualities may be due to varying amounts of elements which are not ordinarily determined in the chemical analysis of pig iron, but the fact remains, nevertheless, that these unexplained differences do exist. This matter was brought to our attention recently in some correspondence concerning a high silicon pig iron sold under the name of Globe pig iron, Chas. G. Shepard, 401 Ellicott Square, Buffalo, N. Y., being the agent. This pig iron is peculiar, in that it is manufactured from an iron ore occurring in Jackson county, O., and containing only about 25 percent of metallic iron. In order to produce the high silicon irons made at this furnace, it is necessary to use a very much greater proportion of coke than is required for melting the ordinary ore to produce an ordinary grade of pig iron.

They have grades ranging from 6 to 10 percent in silicon and with the carbon ranging from a little less than 3 to less than 2 percent. This grade of iron has been made and placed on the market for a great many years and it is used by many stove manufacturers and others to counteract the bad effects which result from the necessary melting of a large proportion of sprues or remelt. As is frequently stated, this iron will take the "sting" out of the mixture, which would otherwise result from the large proportion of remelt.

Many of the users of the iron claim that better results can be obtained by introducing a certain proportion, that is, from 5 to 10 percent of this brand, into their mixture, and thus avoid the changing of the quality of the iron greatly, but at the same time increasing its strength by counteracting the effect of the sulphur. It would be interesting to know whether or not this result is due wholly to the high percentage of silicon present, or whether or not it is due to other elements not ordinarily determined. It is probable, however, that the principal secret lies in the fact that this iron is remarkably pure and serves to introduce a considerable proportion of silicon without introducing other and undesirable elements. Another point is that while this iron costs considerably more than ordinary pig iron, it is undoubtedly cheaper to introduce a certain amount of silicon in this way than it would be to buy an iron of the desired grade of silicon in the first place.

It would be interesting to hear from others who have had experience with southern irons which are said to have quite different properties, even though the analysis may be apparently identical. A. READER.

A CASTING DIFFICULTY.

BY P. M. WOODEN.

In the December number of *The Foundry* there is an article with the above title, by G. L. B. If he will heat his shaft to a red heat before putting it into the mold it will help matters. It does not have to be red hot when put into the mold, but should be heated to a red heat just previous to this time. It should also be anchored in the cope side, the same as they would with a dry sand core, for the molten metal flowing along the under side or drag half, expands one side, causing the ends to move out of center. He should also build a flow off gate and flow 50 or 75 pounds of iron through the mold, which will remove all tendency to produce honeycombed or spongy iron. I hope that this will help the brother out of his difficulty.

The H. E. Hessler Co., of Syracuse, N. Y., have secured additional property in what is known as the North Side of Syracuse, and will build a plant there to work in conjunction with their other stove foundry.

REVIEWS.

PRODUCING SOUND CASTINGS.

Eisenzeitung, Oct. 6.—Another discussion on this question. Care should be exercised in the selection of the molding sand. If not open enough, gas pockets are sure to result. If too open, the metal will tear away particles and cause scabs. Drying the mold suitably may overcome defects in the molding sand somewhat. Thus a gummy sand must be dried with a pretty sharp heat; while a lean, open sand must be handled cautiously, and with low temperatures. Furthermore, sufficient new sand must always be well mixed with the old before new molds are made.

If at all possible, the mold should be placed in such a position for pouring that the cope side receives any machining to be done subsequently. This removes the portions likely to be unsound, as well as shotted places and other surface defects.

The gates must be just large enough to pass the necessary amount of iron, and no larger. Pouring the castings with dull iron is apt to give sounder castings than with very hot metal, as the latter keeps on disengaging gases which may be held under the skin.

Pouring from the bottom with whirl gates gives cleaner iron than top pouring, a fact readily seen in roll making. Specially good molding materials must be used in this case, as the cutting action of the stream is severe. Plenty of risers are recommended as a paying proposition.

Finally, it is necessary to use the right kind of metal. At least 2% of silicon, and as little manganese as possible, is essential. To give good wearing qualities, add 10% steel to this mixture.

MOLDING MATERIALS.

Eisenzeitung, Dec. 29.—Under this caption the various materials going to make up a mold are discussed. We take therefrom the main points which are of interest at the present time, inasmuch as the U. S. Geological Survey is now engaged in studying the natural molding sands of the country.

Molding sands in general must have the following characteristics: They must allow themselves to be molded up, retaining their shape well. Must be able to resist the pressure of the metal as well as its cutting action. They must be porous enough to allow the gases to escape through them readily. They must be refractory enough to stand the temperature of the metal without burning on or disintegrating. They must be free from substances which give off gases, as for instance carbonates; as well as fluxes, such as lime and iron oxide. Finally the molding sands must crumble easily after shaking out, so that they may be readily tempered up again.

To go into more detail. In order that the molding sand may be suitable for foundry work, the particles of sand must possess certain required properties. They must be as rough and angular as possible, and not round or smooth. The water used for tempering acts as a binder to some extent, and must be replenished as it evaporates. The molder judges this by the feel of the sand. If the sand is not porous enough, this water on being brought in contact with the molten metal, and turning to steam, is forced to pass through the body of the metal, causing it to boil, and always makes trouble. Hence the necessity of copious venting occasionally with some sands.

The two properties of sand, to be plastic enough to mold up well, and at the same time to be quite porous, are really diametrically opposite, and hard to combine in the same sample. The property of molding up well is due to a large amount of clay in the sand, making it plastic. This in turn makes the sand denser, and less permeable to gases. Experiments have demonstrated that very fat sands, that is with less than 85 percent silica, and 10 to 15 percent clay, are impervious to the passage of gases, and only when heated up to 575 to 625 degrees F., or in other words, "burnt," will they pass the gases in the iron. The finer the sand the greater this difficulty. If fine sands must be used the microscope should be taken to see that the grains are rough and angular. The size, while hard to designate absolutely, should be about one sixth of an inch in diameter (which would seem a little large). Finally the sand should be as uniform as possible in the size of the grains and be free from dust. To test the permeability of sand for gases, the samples should be put into suitable receptacles, pressed equally hard, and then brought to equal dimensions. Water is then dropped on with a graduate or burette. The sand which takes up the most water will be the one which passes the gases best.

A sand must keep its shape when the hot metal strikes it. If the sand cracks up in

its grains and goes to dust there will be trouble. Thus the sand may contain carbonate of lime, which decomposes under heat. Or there may be hydroxides which disengage water and destroy the integrity of the material. Finally there may be hair cracks in the grains of quartz which have moisture in them. When the hot metal strikes these, they fly apart. In any of these cases the presence of the proper amount of clay will not give the desired results otherwise obtained.

For heavy pieces of work, or for steel, a sand is used which has more clay in its make-up. In fact it is a clay which would shrink too much on heating, and hence has added to it quartz, burnt clay, ground crucibles, and the like. Here the shrinkage of the clay portion creates hair cracks which, however, are not continuous, as the grains of sand or other material breaks their continuity. The result is that no trouble is experienced from that source and the gases can pass off all right.

For loam work, the material used shrinks very much, and hence it is necessary to add some organic matter as a binder to counteract the deleterious shrinkage effects. Short straw, cow-manure, calf's hair, increase the binding power and when baked the mold will pass off gases all right. Sea-coal dare not be used as a facing, as the gases formed are too voluminous, and could not get away. Hence graphite or coke dust is used for the wash. The more sand is found in the loam, the less graphite or coke dust may be used, and vice versa.

Among the substances which may be used for binders in coremaking, we note potatoes, boiled and mashed, then being mixed with the core-sand.

MEMORANDA ON GERMAN MALLEABLE CASTINGS.

Giesserei-Zeitung, Dec. 15, contains an article by F. Eckert, from which we take a few points of interest. Swedish and English charcoal irons with 3 to 3.5% total carbon, and as little sulphur and phosphorus as possible, are recommended, the silicon and manganese being low. For the steel additions old files are specially included. For annealing purposes the spathic iron ores are used, as well as hammer scale, rusted wrought iron turnings, and occasionally oxide of zinc. The last mentioned medium is certainly a new one to us. After giving some molding directions of a general nature, which agree with our American practice, Mr. Eckert presents a table of mixtures to be used for malleable castings of thicknesses ranging from ¼ to 1¼ inches. In the first case he gives 75% gray pig iron with 25% steel scrap; and in the last, 37% gray pig iron, 8% white pig iron, and 55% steel scrap. These figures are astonishing to us here, for with so much steel it is a question of how much shrinkage we would have to contend with, what the percentage of cracked castings would be, and the certainty of a very poor anneal. In Germany, however, they anneal for a longer period, and at comparatively higher temperatures. The fracture of their castings is not black, as ours, but of a steely nature.

For comparison with our costs those in Germany are given herewith, converted to a tonnage basis (2,000 lbs.).

Iron	$28.41
Coke (crucible process)	9.09
Crucibles	6.82
Labor, melting	3.41
Molding cost	22.73
Molding material	2.27
Cleaning	2.41
Annealing labor	4.54
Annealing fuel	2.82
Annealing material	3.41
Supplies	2.73
Interest, depreciation	1.82
Total	$90.46

or about 4.5c a lb.

While these figures are claimed to be high, and the process is the antiquated crucible one, which seems, however, to be the standard for Germany, yet a few of the cost items can be compared with our practice. Thus the molding cost would seem excessive, as also the annealing labor, remembering that wages are very much less in Germany.

As we are selling malleable castings between 2.2 and 3 cents a pound at the present writing over here, the above cost figures, even conceding a high pig iron price, would indicate that we are a trifle ahead in the game.

ON THE INFLUENCE OF SILICON, MANGANESE, CARBON, SULPHUR AND PHOSPHORUS IN PRODUCING TEMPER-CARBON IN MALLEABLE IRON.

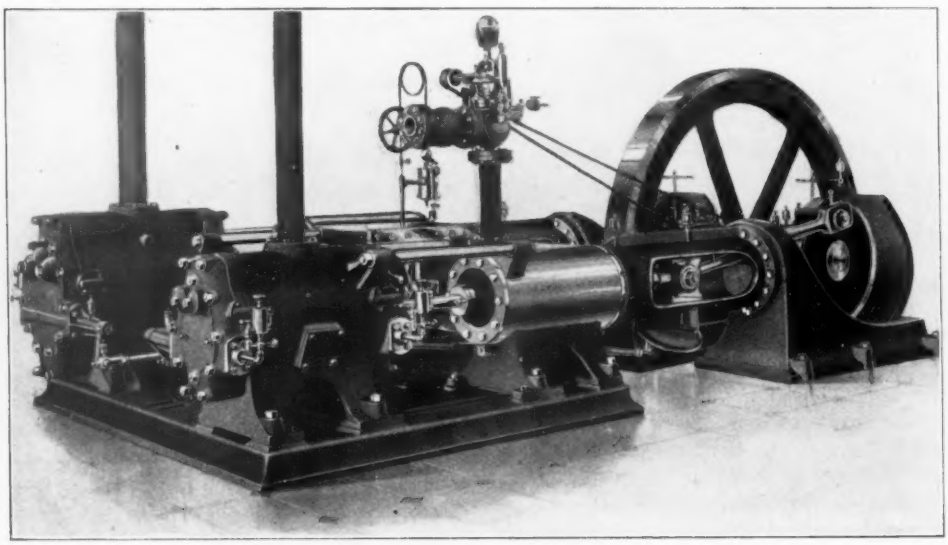
Stahl und Eisen, Oct. 1.—Prof. Wuest and P. Schloesser experimented with practically pure iron to which additions of the elements named in the title had been added while in the crucible. The results were as follows: Carbon (made from sugar) added to the cold charge, in an old crucible, brought the metal up to 4.4 percent. The silicon was about 0.03,

manganese 0.03, phosphorus 0.014, and sulphur 0.008. The test pieces were cast into iron ingot molds, and afterwards packed in cast iron borings in a crucible, and then annealed in an electric furnace. Temperatures were taken with the Le Chatelier Pyrometer. The conclusion reached was that the higher the carbon contents, the greater the tendency to separate out the temper carbon. The reaction begins suddenly at about 1,800 degrees F. and keeps throwing out the carbon heavier as the temperature gets higher. (Unfortunately this does not quite agree with daily malleable practice, where the slow heating up of an oven shows the separation out of the temper carbon completely beginning with 1,250 degrees F., and not running higher than 1,350. Silicon 0.35, which would indicate that laboratory experiments do not always go hand in hand with actual experience.) Silicon has a great part to play in this reaction, as it has been found, and the tables given show that with higher silicon the annealing temperature comes down considerably. This comes more nearly to actual conditions. Our experience in America goes one step further in that we notice quite a distinction between metal made by the cupola process and that from the air furnace, or the open-hearth. The former anneals at a temperature several hundred degrees higher than the latter two methods.

One statement is made which we cannot agree with either, and that is when the silicon contents goes below 0.50, the castings must be annealed twice to be of good quality. The very best malleable should contain below 0.45 percent silicon, and even with 0.28, only one anneal is amply sufficient.

The addition of manganese, made by metal produced in the Goldschmidt method, proved what most of the malleable people here have gone through, that it is very bad to have in quantity, for it obstructs the annealing process. While the presence of silicon allows a very sudden and marked change to take place, when too much manganese is there, the deposition of the temper carbon is so gradual that it may be called very slow.

Sulphur acts similar to manganese and is also known to be very injurious to the material. Phosphorus, if not present in too great a quantity, has no special effect either way.



A NEW AIR COMPRESSOR.

A NEW AIR COMPRESSOR.

The accompanying illustration shows one of the air compressors recently furnished the Penna. R. R. Co. for their new shops at Altoona, Pa. These machines were designed and built by the Chicago Pneumatic Tool Co., at their compressor plant at Franklin, Pa. They are designed to run non-condensing, with a boiler pressure of 100 pounds, and the capacity of each compressor is 700 cubic feet of free air per minute when running at the speed of 100 r. p. m. The steam cylinders are provided with Meyer adjustable cut-off valves,

and the air cylinders with mechanically operated inlet valves of the Corliss type and with poppet valves for the discharge. All parts are designed to give ample working surface and to insure continuous cool running. An intercooler, which is not shown in the illustration, is provided, and located between the high and low pressure air cylinders. The cylinders have comparatively small bore and long stroke, so as to reduce the clearance volume to the minimum. The governor is furnished with a pressure regulator, which stops the machine when the pressure in the receiver exceeds the desired amount. The governor is also provided with a safety device which stops the machine in case of any accident to the governor belt.

ASSOCIATIONS AND SOCIETIES.

Philadelphia Foundrymen's Association.

Howard Evans, Secretary, care J. W. Paxson Co.

The Philadelphia Foundrymen's Association held its 144th meeting at the Manufacturers' Club, Philadelphia, on Wednesday evening, Feb. 1. Thomas Devlin, president, occupied the chair, and the meeting was called to order at 8:15, with 65 members and visitors in attendance. The treasurer's report showed a cash balance of $2,129.09, all bills being paid to date.

Secretary Evans stated that several of the members accepted the invitation and attended the annual meeting and dinner of the New England Foundrymen's Association at the Exchange Club, Boston, Mass., on Jan. 11. He then called upon Mr. Brown, who was one of the party, to make a report. Mr. Brown said that the members from Philadelphia were royally received and entertained, the meeting being quite largely attended. In presenting a neatly framed etching of the Old North Church, the hearty wishes of the New England Foundrymen's Association were extended to President Devlin and the members of the Philadelphia association, and special attention was called to the Historic Association of Boston, and in particular the history of the Old North Church. In closing his remarks Mr. Brown made a motion to the effect that the secretary be instructed to formally acknowledge the receipt of the etching referred to, and that he endeavor to have the same placed upon the wall of the meeting room at the Manufacturers' Club, provided satisfactory arrangements could be made with the board of governors.

The members were invited to attend a meeting of the Franklin Institute on Feb. 2 and hear a lecture to be delivered by Mr. Richard Moldenke on "Testing of Cast Iron."

Edwin A. Moore, president of the American Coke & Gas Construction Co., Camden, N. J., was then called to read his paper on the subject of "By-Product Coke as Made by the Coke Oven Plant of the Otto-Hoffman and United-Otto Types, Camden, N. J."

Pittsburg Foundrymen's Association.

F. H. Zimmers, Secretary, care Union Foundry & Machine Co.

At a meeting of the Pittsburg Foundrymen's Association, held at Pittsburg, Monday, Feb. 6, J. S. Robeson, president of the American Glutrose Co., Philadelphia, read an interesting paper on "Core Binders." Much information with reference to core making was given and the low percentage in mixtures of some of the binders used was a surprise to many. Most of the foundrymen agreed with Mr. Robeson that the sand for making cores was of first importance, and that the binder was of secondary consideration. While different binders were used by many of those who took part in the discussion, it was generally agreed that for overhanging cores flour must be used as a binder. One of the foundrymen showed a core to the visitors in which glutrine was used as a binder in the ratio of 50 to 1 and even this core was too hard for general practice. The proper proportion in this instance should have been 75 to 1. It was claimed that this substance was used by some of the foundrymen in the ratio of over 100 to 1 with excellent results.

New England Foundrymen's Association.

Fred F. Stockwell, Secretary, care of Barbour-Stockwell Co., Cambridgeport, Mass.

The regular monthly meeting of the New England Foundrymen's Association was held at the Exchange Club, Boston, on Wednesday, Feb. 8. Report of progress was received from the committee on pig iron storage warrant system, and it was announced that the committee expected to have Geo. H. Hull, president American Pig Iron Storage Warrant Co., present at the next meeting to give further information relative to this subject.

After a short intermission the meeting adjourned to dinner, after which the president introduced Mr. Henry Souther, of the Henry Souther Engineering Co., Hartford, Conn., who gave a very interesting address on the

"Physics of Cast Iron Practically Considered." At the conclusion of the address a unanimous vote of thanks was extended to Mr. Souther.

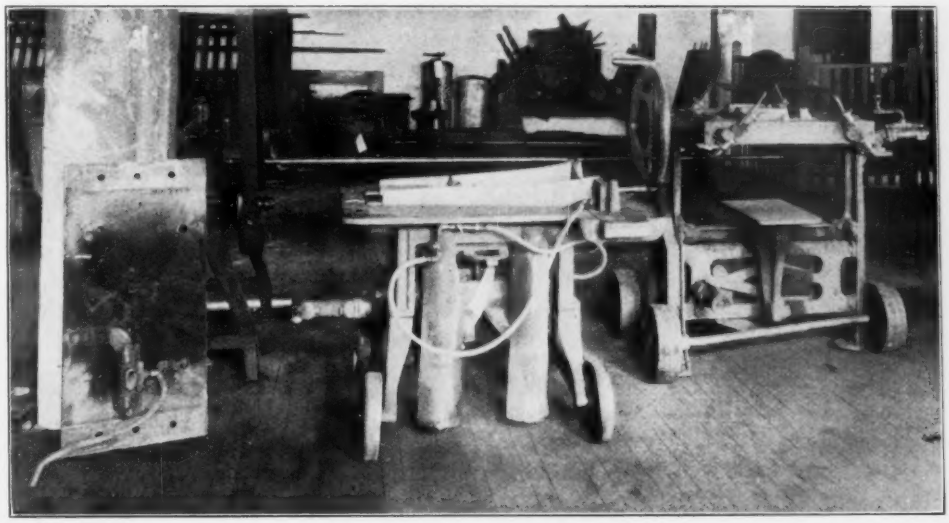
Cleveland Foundry Foremen.

W. H. Nicholls, 608 Gordon Avenue, District Vice President.

The Cleveland Foundry Foremen have had two meetings recently. On January 30th they met at their usual meeting place and then proceeded in a body to the power block occupied by the Berkshire Mfg. Co., where there was a combined exhibit of molding and coremaking machinery by the Berkshire Mfg. Co., and Mr. Wadsworth, of Cuyahoga Falls, O. Mr. Wadsworth brought down a car load of machinery from the Falls Rivet & Machine Co., Cuyahoga Falls, O., including several different types of molding machines made by different manufacturers. These were exhibited to illustrate the different methods of securing the patterns to the machines. He also exhibited one of his core machines driven by an air motor, and also a grinding machine for pointing the cores. The Berkshire Mfg. Co. exhibited two of their automatic molding machines fitted up for different classes of work. One of the machines was fitted up for making car brasses, and certainly showed remarkable results as to the time occupied in making the mold, and as to the number of pounds of castings which could be obtained from a flask.

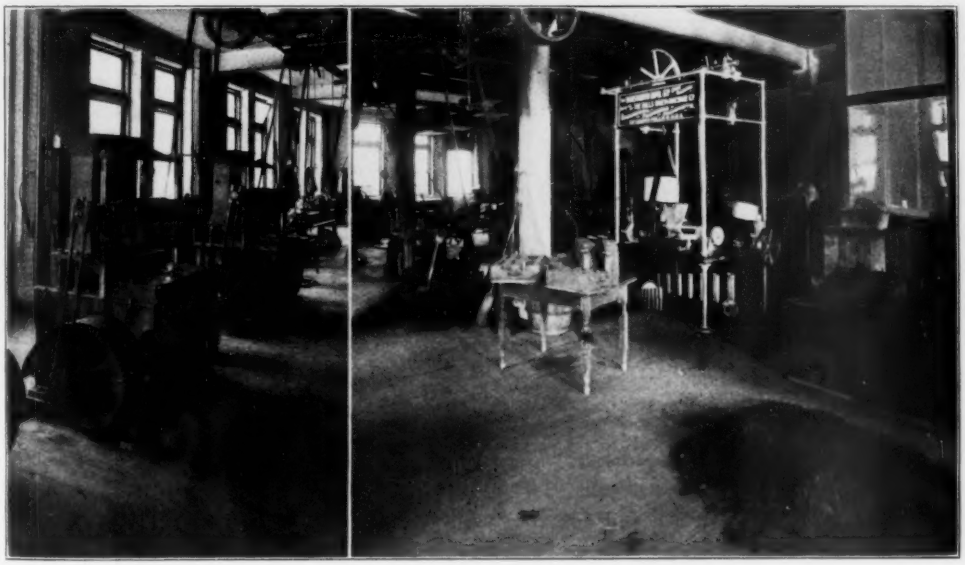
There were two papers read before the members went to the power block. These papers set forth the advantages of some of the machinery and explained it. Mr. Wadsworth read a paper on molding machines and prefaced his remarks with a statement concerning the object of the Foundry Foremen's Club. He urged every foundry foreman to attend the club and to make it a place where the foundry foremen could obtain help in the solving of their various problems. He also pointed out the fact that with our modern foundry conditions, including as they do the

CLEVELAND FOUNDRY FOREMEN AND FRIENDS AT THE BERKSHIRE MANUFACTURING CO.



MOLDING MACHINES SHOWN TO ILLUSTRATE MR. WADSWORTH'S PAPER.

molding machine, it would be necessary to have the foremen patternmakers associated with the foundry foremen, as the solution of the molding machine problem is one in which both the molder and the patternmaker are interested. He pointed out the fact that the different molding machines were suitable for different classes of work and that when a foundry was to be equipped with molding machinery, it was often best to have the foreman visit other foundries and also to discuss his problems with the foundry foreman of other plants. He then stated some of the points of interest concerning the exhibits which he had brought to Cleveland. Among the machines exhibited there was a squeezer machine intended for light work where small or medium quantities are required. A match plate machine of the old type made about 15 years ago, which, on account of the great expense of the match plates, is not used extensively at present, was exhibited, and Mr. Wadsworth stated that they were now making but few patterns for these machines.



1. BERKSHIRE AUTOMATIC MOLDING MACHINES. 2. EXHIBIT OF WADSWORTH IMPROVED CORE MACHINES.

The match plate machine originally had a ratchet vibrator attached to it, but about twelve years ago it was removed and an air vibrator substituted for it. There was also a hand ram and stripping plate machine, which was arranged partly as a stripping plate and partly as a vibrator machine.

Mr. Wainwright, of Cuyahoga Falls, also read a paper on core room practice, in which he pointed out the difference between past and present practice in the core room. He made a plea to the foundrymen to allow their foremen to go about and see what was being done in other foundries, and also for the introduction of more modern methods and tools in the core room, his own core room being equipped with modern drying ovens, core machines, etc., he stated the advantages which his company derived from them. He also pointed out the advantages of machines for riddling and mixing sand.

The accompanying illustrations show a flash light group of a few of the foundry foremen and their friends who were present, together with some of the machines which were on exhibition. After spending an hour and a half looking over the machines and exhibits, the foundrymen adjourned to the office of *The Foundry*, where a discussion on molding machines and core making took place, in which many interesting and useful points were brought out.

On February 14th there was a lecture on thermit at the Case School of Applied Sciences, by Mr. Stutz, vice president of the Goldschmidt Thermit Co., of New York City. The arrangements for the lecture were made jointly by the Civil Engineers' Club of Cleveland and the Foundry Foremen's Club. There was a large attendance and every one reported having had a good time and having learned a good deal about the application of thermit. Some of the foundry foremen came in from distances varying from 100 to 200 miles to attend the lecture.

On the afternoon of February 15th there was a demonstration of the use of thermit in the foundry at the Interstate Foundry Co.'s plant, which was attended by many of the foundry foremen, foundry managers and chemists.

Titanium thermit was introduced into a ladle to show its effect in purifying the iron, and several test bars made from the metal both before and after the introduction of the thermit. The use of thermit on the riser for reviving dull iron was also demonstrated.

Erie Foundry Foremen.

W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

The Erie Foundry Foremen held their regular monthly meeting in Marquette Hall, Feb. 6th. President Grunau presided and there was a full attendance. After reading the minutes of the previous meeting and transacting the routine business, a very interesting talk was given on "Chemistry as Applied in the Foundry," by Mr. Jas. A. Evens, Chemist of the Erie City Iron Works, and Mr. Henry C. Pritham, who conducts a laboratory in the city, also spoke on the same subject. The talks were most interesting and appreciated by all present. A vote of thanks was tendered the chemists and a hearty invitation extended to them to meet with us regularly.

Philadelphia Foundry Foremen.

W. P. Cunningham, Secretary, Pencoyd, Pa.

The Fifth regular meeting of the Association was held at their new meeting place, 1425 Filbert St., Wednesday evening, Feb. 15th. President A. T. William was in the chair and in the absence of Mr. Cunningham, the secretary, W. O. Steele, acted as secretary. There was a good attendance in spite of the intensely cold and stormy weather. The subject of the evening's discussion was shrink holes and feeding heads, and it was very ably handled. Pieces of defective work or descriptions of different difficulties along this line which were brought in by the members were examined and discussed to the mutual advantage of all. The chemical end of the problem was discussed and the effects of the various elements of the "mix" were argued pro and con to the profit of all present.

Some new core compounds also came in for their share of discussion and the results which some of the members were obtaining with them were reported.

After the meeting a good social time and a fine luncheon were thoroughly enjoyed by every one. Meetings will be held regularly on the third Wednesday of each month at the new meeting place, where a large and well lighted room has been set apart for the use of the Association on its regular meeting nights.

THE ASSOCIATED FOUNDRY FOREMEN.

Frank C. Everitt, Secretary, 2413 Third Ave., New York, N. Y., care The J. L. Mott Iron Works.

NEW YORK FOUNDRY FOREMEN'S ASSOCIATION.
S. M. Williams, Dist. Vice Pres., 221 Third St., Elizabeth, N. J.

INDIANAPOLIS FOUNDRY FOREMEN.
W. H. Holmes, Dist. Vice Pres., care American Foundry Co.

CHICAGO FOUNDRY FOREMEN.
David Spence, Dist. Vice Pres., 142 Bunker St.

MILWAUKEE FOUNDRY FOREMEN.
Thomas Glasscock, Dist. Vice Pres., care Pawling & Harnischfeger Co., Milwaukee, Wis.

MOLD DRYING METHOD FOR STEEL CASTINGS.

Forgings are gradually being replaced by cast steel in the construction of locomotive frames not only on account of the lower cost of the steel but because the steel suitable for frames shows a tensile strength of about 75,000 lb. per sq. in. as compared with 53,000 to 54,000 lb. per sq. in. for the best hammered iron.

Owing to the length of the frames, varying up to nearly 40 feet, considerable difficulty has been experienced among steel casting manufacturers in producing them without shrinkage cracks and the consequent loss of an unduly high percentage of castings. C. C. Smith of the Union Steel Casting Co., Pittsburg, has a patented method of drying molds in his plant by which this difficulty has been entirely overcome. The common practice of drying the molds throughout is objectionable in the manufacture of large steel castings, not only on account of the danger of injuring the mold in its removal to the drying oven but also because the baked mold does not break or disintegrate under the shrinkage of the casting, and as a result the latter becomes strained and frequently full of shrinkage cracks. By the new method only the face of the molds is baked, leaving the main body easily friable, so that the mold will readily break down under the strains due to the shrinkage of the casting.

In drying the mold the cope is superimposed

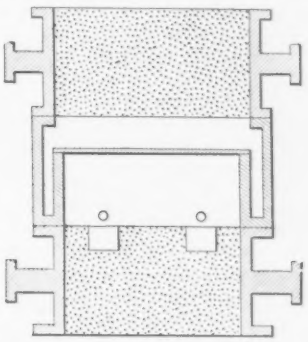


FIG. 1. METHOD OF PLACING COPE OVER DRAG.

on the drag shown in Fig. 1, and a perforated gas pipe is introduced between them, the gas being burned in the mold cavity between the cope and the drag. A flask section is placed between the cope and the drag to hold them some distance apart, and to prevent the drying of the cope to a greater extent than the drag a baffle wall of thin metal prevents the flame from coming in contact with the cope face. The heat can be continued for any length of time so as to get thoroughly dry mold faces. While the face of the mold will become dry and hard the greater portion of the mold body will still be moist and will easily disintegrate or break down. In the drying of molds for locomotive frames two perforated gas pipes are used as in Fig. 2. This method of drying can be carried out on the molding floor, not necessitating the removal of the drag or cope to a drying oven, the cope receiving a minimum amount of handling, while the drag is not moved at all.

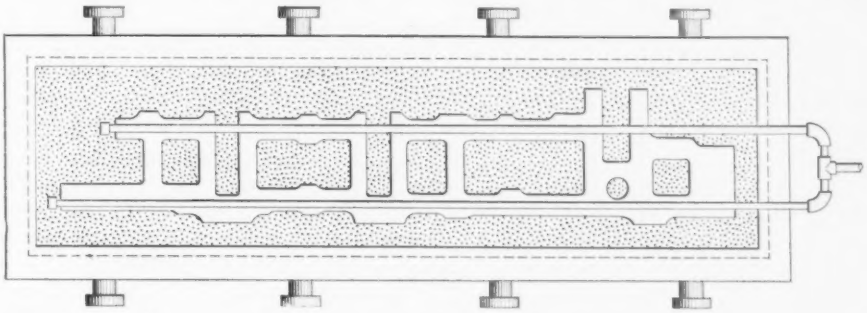


FIG. 2. PIPING ARRANGED FOR DRYING LOCOMOTIVE FRAME MOLD.

METALS IN FOUNDRY PRACTICE.

Devoted to inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron, Steel, Brass and Bronze.

The following experts answer questions in this department:

W. J. Keep, Cast Iron.

J. B. Nau, Metallurgy of Steel and Steel Castings.

Dr. Richard Moldenke, Malleable Castings.

C. Vickers, Brass Castings.

We have also made arrangements with several others to act as special contributors upon Brass, Bronze and other subjects. All inquiries should be addressed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

Aluminum in Iron.

Question. What is the proper way to use aluminum when mixing it with iron?

Answer. As the influence of aluminum in cast iron is the same as silicon, it is cheaper to use silicon for changing combined carbon into graphite; but as it takes only one-sixth as much aluminum as silicon to produce a given effect it is used to make a mixture of cast iron and steel scrap fluid enough to fill a mold and to prevent blowholes about one-tenth of one percent of pure aluminum is placed in the ladle before it is filled with molten iron. The mixture is instantaneous.

Trouble with Sulphur.

Question. Our coke has never contained over .90 percent of sulphur in any case; in this particular case it analyzed .64 percent. The iron charged should produce a casting with .093 percent sulphur, but the analysis showed .114 percent. We used limestone for a flux.

Answer. The limestone evidently contained pyrites. This can be seen by wetting the stone, when they will appear as bright golden spots.

Blowholes in Castings.

Question. We are having trouble with our gray cast iron foundry mixture on account of blowholes. These are clean, i. e., show no graphite deposit in the blowholes. We thought that the proportion of graphite to combined carbon was at fault, but on getting opinions they differ so that we are no better off than at the beginning. The composition seems good, viz., Si. 2.00, S. 0.08, P. 0.49, Mn. 0.60, Total C. 3.75, Graphite 3.00 to 3.30. We do not dare to make the silicon any lower.

Answer. There is nothing wrong with the iron, but with some condition connected with melting or not sufficient venting of the mold. This will disappear in time and it might be impossible to locate the trouble. The amount of silicon must depend upon the quality of castings that you desire, but increasing the silicon would be likely to decrease the blowholes. Melting the iron hotter would also be likely to get rid of the blowholes. For immediate remedy add to the ladle about one ounce of commercially pure aluminum to one hundred pounds of iron (not "casting aluminum"), or place in the ladle before filling it with iron about one-half a pound of granulated ferro manganese. The increase of silicon or the addition of aluminum will make the castings softer while the manganese will not affect hardness or will slightly increase it. It is usual to lay all trouble with blowholes to sulphur in coke.

To Figure a Cupola Mixture.

Question. I want a mixture for ingot molds for brass of the following composition: G. C. 2.21, C. C. 1.06, Si. 1.16, P. .39, S. .10, Mn. .38 percent. I want to make the mixture from the following six pig irons.

Answer. He gives complete analysis of the six irons. Silicons are 2.30, 2.50, 1.76, 2.42, 0.75, 1.60. Phosphor in all but two are twice that desired and Mn. in all but one is nearly double. Evidently these are not actual analyses of the irons. Irons must be purchased that can be mixed to produce the proportions desired. It, however, seems foolish to make so expensive a mixture for this purpose; and why all pig iron? What are you going to do with your remelt?

Suppose that you purchase three pig irons with as low P. and Mn. as you desire and with silicons that will produce the desired percentage in the mixture. To have 1.16 in the casting it should be 1.40 percent in the mixture.

Suppose you purchase A pig iron with 1.00 percent Si., B pig with 1.25, and C pig with 2.00 percent silicon and good machinery scrap with about 1.50 percent silicon. Your home scrap will contain 1.16 percent silicon and we will suppose that you must use 600 lbs. to a charge of 3,000 lbs., so as to use it all up each day. Let us use 1,200 lbs. of the foreign scrap and say that we do not care about the proportions of A, B and C.

	lb. in Mix.	% Si.	lb. Si.
Home Scrap	600 ×	1.16 =	6.96
Foreign Scrap	1,200 ×	1.50 =	18.00
	1,800		24.96
Charge	3,000 ×	1.40	42.00
Needed	1,200 ×	1.42 =	17.04

1.42	A pig iron	1.00	— .42	58		58	Total parts
	B " "	1.25	— .17		58	58	175
	C " "	2.00	+ .58	42	17	59	

1,200 ÷ 175 = 6.86 lbs. to one part.
58 × 6.86 = 397.88 lbs. of A.
58 × 6.86 = 397.88 lbs. of B.
59 × 6.86 = 404.74 lbs. of C.

Proof using even weights:

Home Scrap	600 × 1.16 =	6.96
Foreign Scrap	1,200 × 1.50 =	18.00
A Pig Iron.....	400 × 1.00	4.00
B Pig Iron	400 × 1.25	5.00
C Pig Iron	400 × 2.00	8.00
	3,000 × 1.40 =	41.96

If it had been desirable to use a large quantity of any of the pig irons on account of a shortage of some others, figure the quantity of such pig iron in with the home and foreign scrap and balance only two pig irons.

The usual way is to estimate all of the quantities and then figure the silicon in such mixture as in above proof. If too small or too great a percentage is found vary irons and figure again as in proof, and so on until you get the correct mixture.

To make a success of mixing by analyses you must first get a correct analysis of each iron used. If you guess at the analyses of the different irons you might almost as well guess at the amounts to use in the first place.

You must in any case guess at the composition of foreign scrap and to find whether your mixture is satisfactory you had better measure the shrinkage of a test bar from the same iron as the casting and compare it with the shrinkage of a test bar from an iron that has proved satisfactory.

If the shrinkage of your mixture is less you can decrease silicon by using more A pig; if the shrinkage is greater increase the silicon by using more C pig iron. This saves all analyses and saves all figuring, is inexpensive and the result is obtained as soon as the test bar is cold. This is mechanical analysis.

MALLEABLE CAST IRON NOTES.

BY DR. RICHARD MOLDENKE.

E. K., of Sheffield, England, writes as follows: We are using ordinary draught and clay pots for melting our white iron for malleable castings. Ours is a small shop employing six molders, and we have a variety of work from ounces to 100 lbs. Can we use a small cupola to advantage?

In answer to this I would say that for so small an output, by all means stick to the crucible process. In any case the use of the cupola for malleable castings weighing 100 lbs. is not to be recommended, as the product will be inferior to your present castings. If you desired to increase your capacity, and had the bulk of it in very small castings, the cupola would be all right, provided you can get pig iron with lower sulphur than seems to be the rule in England. When your output reaches two or three tons daily, you can put in a small air furnace to advantage. This air furnace, by the way, is not a reverberatory with crucibles; but for direct melting on the hearth.

E. K. writes further that his iron requires at least six days for the complete annealing process, and asks would "black heart" iron take less. In England black heart metal is the name given to our malleable castings, their own product being annealed until the carbon has all passed out of the metal leaving it nearly like steel. While our black heart castings can be annealed in less time, we never take less than six days for this purpose, unless pressed on deliveries. And then the work is bound to suffer. Black heart malleable castings will therefore be not cheaper than the white castings of England, in fact they might be dearer, for the pig iron used must be of good quality to get the black heart at all. Pig irons with sulphur over 0.07 are apt to give trouble in that respect.

BRASS FOUNDRY NOTES.

BY C. VICKERS.

Lead in Alloys.

We should like some practical information relative to the best method of treating brass and bronze mixtures containing a large percentage of lead and zinc so as to secure a uniform mixture, or in other words, prevent their separation at the time of cooling without having to plunge the castings in water.

Answer. Copper alloys with zinc in all proportions, it is a perfect alloy, and the zinc never separates from the copper.

Copper and lead do not form a perfect alloy, the lead always has a tendency to separate, but the copper will retain the lead much better if no zinc be present in the alloy. When zinc is added in large amount to a copper-lead alloy, the copper alloys with the zinc to form brass, and lets go of the lead which oozes out of the castings. Small quantities of lead and zinc, will, however, form an alloy with copper; for instance, two ounces each of lead and zinc alloy with sixteen ounces of copper to form a variety of red brass.

But when it is desirable to alloy a large amount of lead with copper as in the pot metals, zinc should never be present, as it will promote a segregation of the lead.

No method of treatment will compel the copper to retain the lead in large amounts; it will always ooze out more or less. This is why an alloy of eight ounces lead to sixteen ounces copper is known as "wet pot metal."

The retention of lead may be promoted by the addition of tin in small quantities by the use of antimonial lead in place of soft lead, and by constantly stirring the alloy while casting.

Brass Mixtures.

Question. I am an iron molder, but at times am called upon to make brass castings ranging from 1 oz. to 1,200 lb. The heavier castings I make out with all right, but it seems impossible for me to turn out small castings with a clean skin and a good color, and that will file easily. Have tried many mixtures of copper, tin and zinc. The nearest I have come to getting what I want is to use a composition of 85 copper, 5 tin, 5 zinc, 5 lead and ½ lb. metallic phosphor. This gives me a good working metal for lathe work, but does not file very easily, and if knocked out hot the color is not good, but if left to cool in the mold it has a very nice color. Now, I would like to get some information on this subject.

My sand is Philadelphia sand and I do not think it is fine enough for light work and it contains a grit that gives trouble in cutting gates. It works nicely on castings weighing from 10 to 100 lb. The metals I have are copper, tin, zinc, lead and metallic phosphor.

Answer. I must say this correspondent is very fortunately situated with regard to metals.

With copper, tin, zinc and lead at his disposal, not to speak of "metallic phosphor," he ought to turn out brass castings with a color like a sunflower.

The mixture given is pretty near an "ounce metal." It is a good alloy, but not quite suitable for small castings that must machine easily. Try the following alloy:

Copper	50 pounds.
Zinc	5 "
Lead	5 "
Tin	1 "

The tin may be omitted in castings desired very soft.

The sand is evidently too coarse for small castings; get some fine brass sand, or if that is not obtainable, take the coarse sand, strew it on the floor and let it get trampled on and dry as dust; screen this dry sand through a fine sieve. The one I use I call a No. 60, but I never counted the mesh. This sieve will take out all the grit and by constantly screening all dust, a pile of fine sand will be gradually accumulated, which can be kept to itself and used for small work. New sand may be added as required by drying and screening.

Do not get any iron molders' facings mixed up with this sand, if you want a color on the castings; dust flour only on the molds for small brass work.

Also keep iron out of the metal. Too much enthusiasm in stirring with an iron skimmer has spoilt the color of many a heat of brass.

Another thing, do not cut huge gates on small brass castings; experiment to see how small they can be made and not "draw," "shrink" or run "cold shut." Where there are small chunky castings put a feeder near them, in the shape of a boss, in the cope of runner or gate.

Shake out the castings; as soon as the redness has cooled from the sprue tap the sand off and quickly dip them in water; get them under water before the orange color fades to green. My remarks at the beginning were called forth by the fact that many founders do not furnish the component parts of the alloys, deeming them too expensive. All you get is a pile of junk, a pig of lead and a slab of zinc, out of which one is calmly expected to make "nice red brass," "bell metal," "steam metal," "gun metal," "yellow brass," "phosphor bronze" and so forth, so that any one who has access to copper, etc., is indeed fortunate and only needs a little perseverance in experimenting along the lines laid down to make a grand success.

A WHISKY BOTTLE CUPOLA.

BY JAS. A. MURPHY.

A writer in the January *Foundry* in an article on a Dismal Swamp Foundry happily alluded to a certain style of cupola designed after the fashion of a wine bottle. It was rather an appropriate name for the several monstrosities that are scattered over the country. Some of them melt iron well, but they are all without exception killers of men, and several costly losses have been recorded against them on account of the men being suffocated on the charging scaffold, by the volumes of gas discharged through the door that should be carried up the stack. I well remember one evening having a 15 ton heat which was a little larger than the average and having a large job to pour after the small work was done. I had my large ladles ready and one of them filled, when to my dismay I discovered the cupola was empty. On investigation I found my two cupola men lying out full length in the snow where they had managed to crawl after they were suffocated on the cupola platform. This same thing happened on several occasions afterwards, and was of such frequency particularly in the winter that I had a bell rope suspended from the scaffold in a convenient place so that the men could give an alarm when they found they could not stand the gas and heat any longer, and I then sent a relay of fresh men to finish charging.

Some years ago this contracting of the cupola above the door seemed to be a sort of a fad among the designers of cupolas, although most of what I have seen of them was the handiwork of foundrymen themselves or some of the engineering profession who thought they knew something of foundry practice.

The idea of course was to keep the heat as much as possible in the cupola and use less coke or other fuel. How the heat is to be kept in while the door is open is more than I could ever figure out, as the door is open seven-eighths of the time while the stock is being charged. The flame and gases instead of going up the stack partly come out the door, the amount depending on the amount the cupola is contracted, in other words the smaller the area of the stack above the door the greater the volume of gas that will come through it to cause suffocation and oftentimes fire.

I believe something in the way of sheet iron and bricks could be saved by contracting the shell a couple of inches above the door, but in all cases it is the best practice to have the inside lining straight. This is not meant to attack the excellent practice of leaving the lining project a few inches above the tuyeres. Acting upon the theory that the contraction of the cupola above the door kept in the heat and probably figuring on surprising the whole engineering world by melting at the hitherto impossible ratio of 1 to 20 or even more, a central western mechanical engineer who owned a foundry took off his coat and jingled both his pocketbook and his powerful intellect in the interests of the foundry fraternity. The whisky bottle was his model. His first attempt took the form of the hip pocket variety, oval cupola, but his latter-day designs were all after the common form with which Kentucky and all those living adjacent to its shores are so familiar.

It was rather a laughable circumstance to visitors to see a small pipe sticking through the roof which they always took for the core oven flue. On being told it was the cupola they invariably indulged a good hearty laugh.

When the blast was on, a little smoke issued through it, but at the door it was a sight to see. A huge tongue of flame illuminated the whole surroundings, while from behind a cool corner a faithful workman constantly played a hose.

It had one redeeming feature, the scaffold was high, and nearly always the amount of the heat could be got in before putting on the blast.

If any more had to be put in, the blast had to be shut off, for a man dressed in Harveyized armor plate could not approach it. No door would last more than two heats, so all hands got tired of making any. The cupola floor, the tracks and the iron walls were all warped and twisted out of shape.

Someone may ask why don't they remove the trouble? Well, the people are easily satisfied, then they are well used to that and other troubles, and then again such mistakes as contracting a 54-inch pulley to 16 inches above the door was costly in the first place and would be doubly costly to have it righted again.

Then again some people don't like to have to admit the making of blunders, particularly those who like to save at the spigot and lose at the bunghole.

SHOT IRON.*

BY JAMES BOYLE, SALEM, O.

This subject is an old one, but it has been brought right home to us lately, as we have installed a wet grinder for crushing and washing our daily cupola dump. The product from this grinder has been a surprise. The amount of clean iron reclaimed daily is so great that we feel assured it pays for the expense of grinding it. During April of this year the amount of clean shot, with many good sized nuggets in each barrowful that we reclaimed daily, was over 1,200 pounds.

This is too much iron to throw away, although it is being done by a large number of our foundries. While it seems an easy matter to just charge it into the cupola as scrap, our experience and perhaps that of everyone else is that it is a hard problem to solve.

At first we began to use the shot iron this way: On each of the last two charges of the daily melt we put 500 pounds shot iron. We put it in loose on top of scrap iron, in addition to the regular charge, without any change of kind or amount of pig iron or scrap in the charge. We added extra coke to melt the additional weight.

The result was without any apparent effect on the looks of the castings. For several days we began to think it an easy matter, but from reports that came to us from the machine shop, our first conclusion was dispelled, and before we were through, we found it about as hard a nut to crack as were some of the castings to drill.

We then cut out of the last two charges 500 pounds of scrap iron; in its place we put 500 pounds of shot iron, and on top of this we put 500 pounds of soft silicon pig iron. We took care to pour this mixture into heavy work, with better results, but the shot would show itself, although it apparently melted, and we poured it without trouble. A singular result during this stage was apparent in some wheels poured with iron in which was some of this shot mixture. One wheel 10 feet in diameter, 14 in. face, with rim 4 in. thick, 11,000 in weight, poured through hub and arms, was a good sound casting in every way, but when face of rim was turned off, groups of bright spots the size and shape of the shot iron, were bunched at and near the middle of the rim, mostly opposite the arm of the wheel, with a few stray spots above and below the center. At top and bottom of rim no spot appeared, and the iron there was our regular blue color. The wheel was soft enough to turn off easily and no difference in cutting qualities was noticed between the bright spots and the regular blue iron. I can not explain why these spots were bunched in that manner.

We now began to use more shot iron. We made an extra charge above our daily wants of soft pig and shot iron—equal parts of each—which we poured into pigs. In following heats we used this "shot pig" in our cylinder mixture. The result was better, but castings poured from same ladle would sometimes be of different grades of softness.

From the trials we have made of this side issue, we have found the following to produce the most satisfactory results: It is best to charge shot iron in center of the cupola with pig or scrap piled around it forming a nest.

Shot reclaimed from dump in which there is a large proportion of slag, is not worth the trouble to use. It reproduces so much slag in cupola that it is extra work to overcome its effects. We cart away all the slag we can pick out of the daily dump.

It pays to riddle the shot iron. We use a No. 6 riddle—the smallest pieces we put with the machine shop turnings for sale and we use only the larger shot.

We find that to put on top of the shot charge of 1,000 pounds, about 40 pounds of carbide of silicon helps to reduce the hard and non-mixing effects.

We had the best results pouring heavy work with this shot mixture. In small work it seems to chill so quickly when it comes in contact with the damp mold, and runs hard in lugs and projections reaching into the cope of flasks.

As yet we do not charge the shot iron into the cupola with the assurance we would like. That there is a way to do it we feel certain, but we have not yet solved the problem to our entire satisfaction, and we would be very glad to hear from some of the older and more scientifically equipped foundrymen.

* Paper read at A. F. A. Convention, June, '04.

Since the collapse of the United States Shipbuilding Co., the old Moore Foundries, of Elizabeth, N. J., have had rather a checkered career, but under the wise direction of the Sheldon Co., which now has charge of the property, things are picking up and a large number of new employes have been put to work. The company has a number of contracts, which will keep it busy for several months.

NEW BOOKS.

"A Treatise on Tooth Gearing," by J. H. Cromwell, published by John Wylie & Sons, New York, N. Y., price $1.50. The author of this book states that he is aware that he is treading on well worn ground and that the subject is about as old as the hills, but that in his experience as mechanical engineer he has sought often and urgently, but always in vain, for a terse, compact, yet complete and comprehensive work on the subject of tooth gearing. So that, after having made the subject a study for years he has attempted to boil down the results of these studies into just such a practical work as he himself wanted, and hence he hopes that it will be of interest to other busy men.

Algebra has been used in the book in a number of cases, but parallel with the algebraic solution a rule is always stated, so as to enable a man who does not understand algebra to solve the problems, and the author states that any problem in the book can be solved by any man who has a knowledge of arithmetic. He first takes up the underlying principles of gearing, showing how they may be applied, and how the theoretically perfect form of tooth is developed. He also shows the effect of different sizes of rolling circles upon the character of the teeth, and many other points which will be of interest to those dealing with gearing problems.

In addition to the ordinary spur wheels, he takes up many special forms, such as lantern gears, gears having very small numbers of teeth, bevel gears of all classes, including external and internal, screw gears, including worm and worm wheel and hyperbolic gears. Succeeding this portion of the book there is a section treating on trains of gearing, giving numerous examples of the calculation of such trains. He also takes up the subject of the strength of gear teeth, the strength and design of rims, arms and hubs and other parts, both for plain and curved arms. These design problems are illustrated by examples worked out in detail, showing the complete design of spur, bevel and worm gears, also of internal gears and of gears and racks. The work also contains a treatment of special forms of gears having elliptical, spiral and other special curved outlines. The author also treats intermittent and mutilated gears. The main body of the work treats of epicycloidal gearing, but there is an appendix which treats of involute gearing. This work should certainly be of interest to all patternmakers.

"The Credit Man and His Work," by E. St. Elmo Lewis, published by The Bookkeeper Publishing Co., Ltd., Detroit, Mich. Price, $2.00. This book certainly stands in a class by itself and it would be very difficult indeed to give a review which would furnish even a fair insight into its valuable and interesting contents. In this age we are beginning to look more closely to profits and to figure to see what can be done to produce our product at a lower cost, so that we will continue to make a profit in the face of the ever declining market. The element of credit is one to which very few business men have given serious thought and yet when we consider that 90 per cent of the world's trade is carried on credit, the importance of the subject cannot help but make itself felt.

Experts in credit are now found among those employed by large concerns and are considered essential to any large enterprise, but the average business man has not had time or has thought he did not have time, to give this matter serious thought. The volume under consideration will certainly give to such a man a very instructive and interesting piece of reading, dealing as it does with all phases of the subject. The author first takes up the subject of "what is credit" and then proceeds to discuss its relation to various forms of business and enterprise, as for instance, the care of the business, the organization of the business, the personal character of the management, and so on through a long list of factors which enter into the problem.

Among some of the chapters we may mention at random "Cost of Production," "The Salesman and the Credit Man," "The Slow Pay Customer," "Going to Law," etc. We believe that this work is certainly entitled to the serious consideration of every business man.

A Grate Bar Difficulty.

The writer had trouble with a grate bar difficulty similar to that which has been described in *The Foundry*, and finally got around it by having the center bar or bars, when there were more than two, swabbed so as to make this part of the mold a little damper than the outside part. This chilled the center bars more quickly and equalized the cooling.

"A. SUBSCRIBER."

Lloyd & Son will start a new brass foundry at Rock Falls, Ill.

TRADE PUBLICATIONS.

The Colburn Machine Tool Co., of Franklin, Pa., are sending out a 4-page circular entitled Bulletin No. 17. This is devoted entirely to the work of their Colburn saw table and the work which can be produced upon it. The illustrations show examples of screw cutting and a large variety of practical work for joints, ornamental work, etc.

Baldwin, Tuthill & Bolton, of Grand Rapids, Mich., are sending out a 192-page catalogue, entitled "Saw and Knife Fitting Machinery." While this catalogue is intended primarily for the users of large saw and knife machinery, such as saw mills, planing mills, veneer cutters, etc., the paper nevertheless contains a large amount of information which will be of value to all patternmakers. As a rule pattern shops do not pay sufficiently close attention to the care of saws and also to the care of knives for surfacers and planers. In cases where these tools are taken care of as well as they can be with the facilities at hand, the cost of their maintenance could be very greatly reduced by installing some of the special machinery described in this catalogue.

The Star Shovel & Range Co., of Vincennes, Ind., have issued a catalogue 6 x 9 in., describing the various classes of shovels manufactured by this company. The catalogue covers all classes of foundry shovels.

The Hancock Inspirator Co., of 85-89 Liberty street, New York, N. Y., have issued a small catalogue which is a miniature of their large catalogue, and is intended especially for pocket use. It is 4 by 6 in. and covers their line of goods, being simply a reduced size of their regular standard catalogue.

The Hayden & Derby Mfg. Co., of New York, N. Y., have issued a miniature catalogue of their Metropolitan injectors, this catalogue being 4 by 6 in. and intended for pocket use.

The Electro Dynamic Co., of Bayonne, N. J., have issued three circulars, describing their inter-pole variable speed motors, as applied to different classes of work.

The Model Heating Co., of Philadelphia, Pa., have issued a very useful blank entitled "Model Boiler Order Blank." It contains blank spaces for all of the various appliances which could be desired in connection with a boiler plant for heating purposes. They state that these blanks are intended not only as order blanks on which to order goods from them, but also as blanks on which to enter up the various parts when making an estimate of a contract, so that the contractor will have all of his information before him, arranged carefully and systematically.

The Deane Steam Pump Co., of Holyoke, Mass., have issued a catalogue of their condensers, entitled "D-23." In this they review the principal advantages of the several types of condensers, as applied to steam engines, also vacuum pumps, exhausters, air and circulating pumps, and other auxiliaries. It also contains matter concerning the condensing apparatus for steam turbines. On account of the fact that a steam turbine can exhaust its steam to so much lower pressure and utilize every inch of the expansion, it is evident that in turbine practice, high vacuums obtained by condensers are of greater value than in steam engine practice. Every one having to deal with steam power will find this catalogue of interest and value.

The Ridgway Belt Conveyor Co., 29 Broadway, N. Y., have issued a folder describing their new Ridgway two-belt conveyor system for handling materials. This system is certainly interesting and the circular should prove of interest to all having handling problems to solve.

The Cutter, Wood & Stevens Co., of Boston, Mass., are issuing a series of blotters, on which are printed advertisements for various foundry appliances.

Warren Webster & Co., of Camden, N. J., have issued another catalogue 3¼ by 6 in., entitled "The Cardinal Points of the Webster Feed-Water Heater and Chemical Purifier." This should certainly be of interest to all who have bad water to contend with.

The Ingersoll-Sergeant Drill Co., of 26 Cortlandt street, New York, N. Y., have issued two new catalogues, one entitled "Air Compressors," and known by them as Form 35, which is really composed of advance sheets of the catalogue which they are now preparing, entitled No. 36. This contains a large amount of exceedingly interesting information concerning the latest developments of compressed air machinery and compressed air installations. They have also issued a catalogue of coal mining machinery, known as Catalogue No. 52, in which they describe not only coal mining machinery, but give considerable other matter relating to air compressors, compressed air, its uses, etc.

The National Electric Co., of Milwaukee, Wis., have issued a calendar consisting of a colored picture of a riding scene, in which two horses in the foreground are taking a

ditch. It is labeled "The Thoroughbreds." There is a neat little calendar pad at the lower portion of the picture, and in the upper portion in one corner, the trade mark of the company.

The American Blacksmith Co., publishers of the *American Blacksmith,* Buffalo, N. Y., have issued a very neat little Indian calendar, with a small advertisement at the top and a picture of an Indian girl, who, we presume, is Minnehaha, in the center and a neat calendar pad at the bottom.

W. H. Anderson & Sons are sending out a leaflet describing their crucible tongs, double and single carrying shanks, and foundry shovels and ladles. Their double shanks are made by a special process, so that the weld is located some distance from the shank on the carrying bar, and they claim that this produces a superior article.

The *Ironmonger,* of London, has published the *Ironmonger* Diary for 1905. This is quite a bulky book, containing over 568 pages of advertising, together with a very nicely arranged diary, the pages of which are 8 by 11 in. and are arranged with three days to the page. The diary is interleaved with blotting paper. This would certainly be a very handy book indeed for any one to keep track of his dates in, and we can readily appreciate the fact that many of the ironmongers or iron dealers of England must find this book exceedingly useful. An interesting point in connection with the present issues is that they have sent out two blank mailing cards to be filled out and returned to them. On the first is to be written a suggestion or quotation on any part of the contents of the *Ironmonger's* Diary for 1905, and on the second six questions are answered from information contained in the book. One of these questions is "Which is the best looking page in the advertising section?" Another is "Which firm has used the space occupied by its advertisement to the best advantage?" For the best answers to these cards, they will divide five guineas in prizes.

The Rand Drill Co., of 128 Broadway, New York, N. Y., have recently brought out a publication entitled "Air Power," and state that it is to be issued quarterly. In their editorial announcement, they state that the object of the paper is to keep the public posted as to what is being done by the Rand Drill Company's air power machinery.

Graphite. The Dixon Crucible Co. have issued a special number of their publication, *Graphite,* for January, entitled the "Lubrication Number." In this they take up various phases of the subject of lubrication, showing the many applications of graphite for lubricating purposes.

The C. W. Hunt Co., of West New Brighton, Staten Island, N. Y., have issued two pamphlets 3¼ by 6 in., one describing the Hunt Industrial Railways, illustrating many applications of this system and giving a large number of useful facts concerning installations of this character. The other catalogue is called an "Introduction to the general line of machinery manufactured by the C. W. Hunt Co.," and contains short, concise statements concerning the different types of machinery which they build.

The Brown & Sharpe Mfg. Co., of Providence, R. I., have issued their 1905 catalogue of machinery and tools. This catalogue has been revised and a good many new machines and devices illustrated in it. Some of the old matter has been re-written and arranged in a better form. This catalogue contains so many handy tables and so much useful information that it should be in the hands of all who have to deal with metal work, and especially in the hands of metal patternmakers.

Lord's Advertising Agency, Scranton, Pa., have issued a book called Lord's List of Trade Papers, giving the names of the various trade papers, together with a short statement concerning their specialties and other information which it is supposed that advertisers would want to know. Incidentally the list is of considerable interest for any one desiring to look over a complete list of trade journals to ascertain what journals are published along any given line.

The S. Obermayer Co., of Cincinnati, Chicago and Pittsburg, have issued a catalogue dealing especially with patternmaker's supplies. They claim that from this catalogue one can obtain anything required for his pattern shop, just as from their other catalogue any one can obtain anything required in the foundry. The catalogue is known as R 40 and will be sent free on request.

The Thos. W. Pangborn Co., 42 Dey St., New York, N. Y., are sending out a catalogue describing the sand sifting machinery, magnetic separators, and the core machines which they handle. They are also sending out a blotter, with illustrations of the Hanna pneumatic screens which they handle upon it, also a small folder advertising the corundum

wheels which they handle and giving a very useful table as to speeds for rotation of grinding wheels.

The Westinghouse Machine Co., of East Pittsburg, Pa., are sending out an exceedingly neatly gotten up publication entitled "The Westinghouse Parsons Steam Turbine." One of the most striking features of the catalogue is a comparative illustration of the space occupied by the machinery and foundation necessary for a 5,000 k. w. generating unit of the ordinary Corliss type and one of the steam turbine type. The illustration of the steam engine is an outline sketch which is drawn as though it were transparent and the turbine outfit is placed inside of it. The figure of a man at one side serves as a scale for comparing the size of the two. The pages which follow are so full of interesting and instructive matter that it would be difficult to point out the especial features. It is enough to say, however, that any one who is planning on power installations should certainly give this publication careful consideration before making a decision.

The Goheen Mfg. Co., of Canton, O., have issued a large pamphlet entitled "Hitch Your Wagon to a Star," in which they have described various uses for their carbonizing coating protection for metal work. They illustrate many plants of all classes, in which the steel work has been protected by the material which they manufacture. They have also issued a catalogue entitled "Galvanum" in which they describe their paint manufactured under the above name and which will adhere to and can be used for protecting galvanized iron structures. As in the other publication, they show many illustrations of buildings and structures protected by the material.

Pawling & Harnischfeger, of Milwaukee, Wis., have issued a catalogue entitled Bulletin No. 16, describing their traveling electric hoists. For many classes of work this style of hoist has many decided advantages over the traveling crane and is being used very extensively for a large variety of work. All interested in handling devices should certainly secure a copy of this catalogue.

PERSONALS.

Mr. H. J. Stambaugh, of the Falls Rivet & Machine Co., Cuyahoga Falls, O., has resigned his present position to become the secretary and treasurer of Wm. Tod & Co., Youngstown, Ohio.

Mr. Duncan Sinclair, who has been associated with the management of the Coalbrookdale Iron Works, has recently undertaken the managing directorship of the Sinclair Iron Co., Ltd., of Wellington, Shropshire, England. Mr. Sinclair visited this country some years ago and will be remembered by many of the foundrymen who had the pleasure of forming his acquaintance.

G. A. Hassel has been appointed superintendent of the plant of the Pittsburg Steel Foundry at Glassport, near Pittsburg, where he will succeed D. MacDougal.

Mr. Chas. H. Tucker, late designer and assistant chief engineer with Pawling & Harnischfeger, of Milwaukee, Wis., has accepted the position of chief engineer with the Case Mfg. Co., of Columbus, O., Engineers, Designers and Builders of cranes and special machinery.

Walter S. Allen, who has been superintendent of the Aetna Foundry & Machine Co., Warren, O., went to Pittsburg on Feb. 1st as superintendent of the Pittsburg works of the American Steel Foundries.

C. W. Cunningham, who a few years ago managed the stove foundry at Central City, is now at the head of a new foundry at Waterloo, Ia.

DEATHS.

H. G. Forsberg, of Washington, D. C., of the firm of Forsberg & Murray, fell dead on Jan. 20th. About 25 years ago with his old time friend and school mate, Mr. Murray, he engaged in the machine and foundry business, and the partnership continued until the present time. He was well known, not only in his home town, but by many friends in different parts of the country.

Hugh Caskey, a retired brass and iron founder, of Philadelphia, Pa., died Jan. 19th. He was born in 1844, served his apprenticeship in a brass foundry in Philadelphia, later entered the United States Navy as assistant naval engineer and served through the Civil War. In 1884 he started a brass foundry in Philadelphia and in 1892 went to Newport News, Va. where he founded the H. & W. Caskey Brass & Iron Works, which has since been consolidated with the Newport News Shipbuilding Co. Five years ago he retired from business.

Frederick L. Titsworth, treasurer of the Chicago Brass Co., of Kenosha, Wis., and secretary of the Benedict & Burnham Brass Co., of Torrington, Conn., died at his home in Kenosha on Jan. 24th. He had been connected

with the factory interests of Kenosha for nearly twenty years and almost all his life was spent in the employ of the Chicago Brass Co. and its allied interests.

FIRES.

Fire did several thousand dollars worth of damage to the plant of the Watkins Machine & Foundry Co., of Hattiesburg, Miss., on Jan. 31st.

The local plant of the American Steel Foundry Co., of Sharon, Pa., was damaged to the extent of $6,000 on Feb. 3rd. The most serious damage was that resulting from water which destroyed the molds in the foundry.

The plant recently purchased by John McLain & Son, of Birmingham, Ala., was damaged by fire to the extent of $3,000 on Jan 23d. It will be replaced by a modern stove foundry.

The Eureka Foundry & Machine Co.'s plant at Birmingham, Ala., was burned on Jan. 25th, entailing a loss of $2,500.

The foundry of the Pratt & Whitney Co., at Hartford, Conn., was damaged by fire on the night of Jan. 30th, to the extent of about $1,000. The fire destroyed a portion of the building adjoining the cupola.

On. Feb. 2nd the works of Stewart & Bruckner, of Nashville, Tenn., were damaged by fire to the extent of $25,000, the insurance being $7,000. The most important loss was due to the burning of the patterns belonging to the company.

The plant of the Canton Malleable Iron Co., of Canton, O., was damaged by fire to the extent of $30,000, on Feb. 7th. The buildings burned and a large number of valuable patterns were destroyed. By readjusting the work it was possible to resume work promptly without serious delay in the department.

The engine house, pattern shop, planing mill, and office of the Pittsburg, Shawmut & Northern Railroad Co., St. Marys, Pa., were destroyed by fire a few days ago causing a loss of $10,000.

Fire destroyed a large part of the pattern department of the Reliance Steel Casting Co., at Lawrenceville, Pa., on Feb. 4th. The loss is about $6,000.

The B. & O. Railroad shops at Lorain, O., were damaged by a fire which caused $100,000 worth of damage, on Feb. 10th. The machine shop, erecting shop, part of the round house, and the pattern shop, were all destroyed.

Fire at the Stanley G. Flagg & Co.'s works, Pottstown, Pa., February 11, destroyed the foundry and core house. Loss, $10,000.

The plant of Smith & Caffrey, foundrymen of Syracuse, N. Y., was slightly damaged by fire on February 9th.

NEW CONSTRUCTION.

Plans are being prepared for a new foundry which will be built as an addition to the plant of the Stacey Mfg. Co., at Elmwood Place, Hamilton Co., O.

The Aurora Foundry Co., of Aurora, Ill., are planning to build several new buildings, including a pattern shop which will be 30 by 60 feet.

The Deved Sash Weight Works, Baltimore, Md., will build an addition 16 ft. x 33 ft., one story and basement.

Shunk Brothers, Bucyrus, O., are building an addition to their foundry. The building will be 40 x 70 ft. and will be used for the storage of patterns.

The Eureka Stove Works, of Birmingham, Ala., will build a foundry 80 by 102 feet, also an office building, pattern shop and machine shop. John McLean, Sr., is president and E E. Howard, secretary.

The debris of the plant of the Economy Foundry Co., in Syracuse, N. Y., is being cleared away, to allow the plant of the Central Iron Works to be erected. This new plant will cost about $50,000.

The recent fire at the plant of the J. L. Mott Iron Works, New York City, did not do a large amount of damage and manufacturing has not been interfered with. The company is equipping its new plant and expects to commence operations there in about a month.

The Kinnear Mfg. Co., Columbus, O., has completed plans for the construction of a new plant, 200 x 400 ft., which will be fireproof. The old plant at Fourth and Lincoln streets and the foundry at Scioto and Water streets, will be sold with the land on which they are located.

With improvements contemplated by the Norfolk & Western railroad, the capacity of the shops at Portsmouth, O., will be practically doubled this year. A new tank shop 150 x 175 ft. will be erected this spring. A foundry may also be added to the shops.

The Southern Skein & Foundry Co., of Chattanooga, Tenn., has completed the plans for two buildings, one of which will be 75 by 200 ft. and the other 75 by 125 ft.

The Favorite Stove & Range Co., Piqua O., will erect an addition, 55 x 125 ft., to be used for polishing and japanning departments. Work on another large addition is now making rapid progress.

The Economic Stove Co., Jacksonville, Ill. has purchased a site and will erect a foundry as soon as the weather will permit. It is now having its castings made in Quincy, Ill. The company may also equip its foundry to do a jobbing trade in addition to its own work The following officers have just been elected for the ensuing year: President, C. F. Tonn; vice-president, James O. Priest; secretary, John A. Unglaub. The capital stock has been increased to $25,000.

Herzler & Henninger, of Belleville, Ill., are planning to add a foundry to their plant.

Contracts have been let for the enlargement of the Western Foundry Company's plant at Chicago, Ill. The addition will be 70 by 100 feet.

The Gibson White Co., Chattanooga, Tenn., recently incorporated, will soon begin the erection of a foundry building.

The Phillips & Buttorff Co., of Nashville, Tenn., are planning to enlarge their foundry.

Golden's Foundry & Machine Co., of Columbus, Ga., are excavating foundations for an addition to their foundry 100 by 250 feet.

The Chattanooga Implement & Mfg. Co., Chattanooga, Tenn., will begin the erection of a new foundry as soon as the weather will permit. The floor space of the foundry will be 20,000 ft. At present the plant of the company comprises both implement and foundry departments. When the new foundry is erected, the present plant will be used only for the manufacture of implements after the castings are made. The present capital of the company is $50,000, but application has been made for permission to increase it to $100,000.

The Des Moines Bridge & Iron Works, of Des Moines, Ia., are planning to build a structural iron foundry this coming spring.

An additional annealing oven is now in course of construction at the plant of the Iowa Malleable Iron Co., Fairfield, Ia. An additional room for shipping purposes will also be erected.

The F. V. Deckert Mfg. Co., Ft. Dodge, Ia., which manufactures the Economy Air Radiator, has made arrangements for the erection of a plant the coming summer.

The Duff-Trowbridge Stove Co., Hannibal, Mo., will erect a new building four stories and covering an area 65 x 150 ft. The first floor will be used as a mounting room and the upper stories for storage purposes.

The Hartwell Iron Works, of Houston, Tex., are making extensive additions to their plant.

GENERAL INDUSTRIAL NOTES.

The old Joice foundry at Brattleboro, Vt., has resumed operations under a new management after being shut down for several years.

The Genesee Metal Works, of Rochester, N. Y., report that the year just closing has been a very successful one for their business and that the sales of phosphor tin alloys alone have been sufficient to produce over 2,000,000 pounds of standard phosphor bronze castings. Their superintendent, F. W. Reidenbach, believes that the present year will see their business more than doubled.

Walter H. Storm & Co., Inc., 26 Cortlandt street, New York, are making a specialty of the manufacture of light castings, such as stair treads, risers and newel posts, having made contracts with a large part of the New York trade for the year 1905 for the stair work used in tenement and apartment houses. The company will also turn out machinery castings.

At the annual meeting of the stockholders of the Utica Pipe Foundry Co., Utica, N. Y., the following officers were elected for the ensuing year: President, Henry W. Miller; vice-president, Irving A. Williams; secretary and treasurer, John A. Kernan; superintendent, John K. Gunn.

Mr. Henry S. Manning, of the firm of Manning, Maxwell & Moore, announces the fact that he has sold his entire interest to his partner, Mr. Charles A. Moore, and requests that their many friends will continue their pleasant relations with the firm. The business will be conducted under the firm name of Manning, Maxwell & Moore, at 85-87-89 Liberty street, New York City, as heretofore.

The Reynolds-Chalou Foundry Co., of Troy, N. Y., has elected the following directors for the coming year: James E. Egan, Michael H. Fallon, Michael Norton, and William Quillinan.

The Heindel Foundry Co., Hanover, Pa., has completed the construction of its new plant, which will be equipped and ready to make all kinds of castings by March 1.

The Cleveland Foundry Co., of Cleveland, O., has increased its capital stock from $200,000 to $400,000.

The plant of the Union Foundry & Machine Co., at Catasauqua, Pa., has been sold to Leonard Peckitt, president of the Empire Steel & Iron Co., for $27,500.

Chas. Hanika, of Muncie, Ind., has completed plans for the erection of an architectural iron works and foundry in that city.

The Independent Brake Shoe & Foundry Co., of Chicago, Ill., has been incorporated with a capital of $2,500 to manufacture railway specialties. The incorporators are John P. Floan, F. V. Bissell and M. A. Theiss.

The Pilsen Foundry & Iron Works, of Chicago, Ill., has been incorporated with a capital of $10,000, to do a foundry and construction business. The incorporators are Geo. Patzcker, Emil H. Schintz and Vincent D. Wyman.

The American Bell & Foundry Co., of Northville, Mich., has elected the following officers for the ensuing year: Frank S. Harmon, president; C. S. Filkins, vice president; Wm. Phillips, secretary; R. C. Yerkes, treasurer.

Wm. L. Thomas, of Osakis, Minn., has closed out his business at that point and moved to Farmington, Minn., where he has purchased the foundry of M. Moes, which he will conduct in the future.

The Virginia Foundry & Machine Co., successors to the Virginia Iron Works, of Virginia, Minn., have made many improvements and additions to their plant, including new fire protection apparatus.

The Duggan Hardware & Foundry Co., of St. Louis, Mo., has been incorporated with a capital of $50,000. The incorporators are Marcus C. Duggan, Henry C. and Jemima A. Duggan.

The Topeka Foundry Co., of Topeka, Kan., have completed and moved into their new foundry building. This company was organized some 18 years ago, and up to the present time has been living in rented quarters. They do a general jobbing business in patternmaking, foundry work and machine shop work, though they have a number of specialties, among which is the manufacture of certain line of stoves and some agricultural machinery for local use.

The Woehrle Foundry Co., of West Newark, O., is now operating its plant with natural gas from its own well, and will commence a second well. The company has a lease of several thousand acres in the vicinity of the factory.

The Kuhn Foundry Co., Buffalo, N. Y., recently incorporated, has taken over the plant formerly occupied by the Buffalo Foundry Co. Joseph Kuhn, the general manager, has closed his shops at Niagara Falls, N. Y., and moved the tools, machinery, etc., to the Buffalo plant.

The Penna. R. R. Co. are pushing the work on their gray iron foundry at So. Altoona, Pa., as rapidly as possible, so as to have it in operation early in May.

The Bessemer Foundry & Machine Co., of Butler, Pa., has been incorporated with a capital of $50,000 to do a general foundry business.

It is reported that the foundry of the Fleetwood Foundry & Machine Co., of Fleetwood, Pa., which was burned last December, will probably be rebuilt.

The Akron Foundry Co., Akron, O., has elected the following officers for the ensuing year: President and treasurer, Frank Fiebeger; vice-president, Frank Nolte; secretary, Frank B. Theiss.

I. M. Blusinsky, of Cleveland, O., will engage in the brass and iron foundry business in Cincinnati, O., having secured a site at 511 Freeman avenue.

H. N. Hills, of Gambier, O., who purchased the plant fomerly operated by the Coxey Steel & Silica Sand Co., at Mt. Vernon, O., a few weeks ago, has practically completed the organization of the Imperial Steel Co., of Mt. Vernon, which will own and operate the plant. The entire cost of the plant was more than $400,000.

The H. V. Dockray Brass & Iron Co., of Zanesville, O., has been incorporated with a capital of $10,000.

The Dayton Malleable Iron Works Co., Dayton, O., has increased its capital from $200,000 to $1,000,000. The company increased its capital to an amount that more nearly reflects the value of the business, but with no idea of material expansion other than that made possible by rearrangement.

The change of name of the Crown Casting Co., Jackson, O., manufacturer of soil pipe and fittings, to the Crown Pipe & Foundry Co. does not signify any change of policy in its business except that it expects to add some business in the way of railroad castings and general job work.

The Electric Controller & Supply Co., of Cleveland, O., has placed Mr. Geo. Magalhaes in charge of its eastern office, at 136 Liberty

street, New York, N. Y. Mr. Magalhaes is a graduate of Columbia University and is thoroughly familiar with the company's products.

The Jeffrey Mfg. Co., Columbus, O., has purchased the plant of the Ohio Malleable Iron Co. of that city. The Jeffrey company has for some time been a large holder of stock of the Malleable company.

The Buckeye Steel Castings Co., Columbus, Co., will begin work at once on a new 25-ton open hearth steel furnace. This will make four open hearth furnaces at the plant and enable it to greatly increase its output. A large number of orders are now on hand, especially in the car coupler department. A large amount of work is also being done for locomotive companies.

The Brass Foundry & Machine Works, of Fort Wayne, Ind., are increasing the capacity of their wheel department by adding five more pits and five new wheel floors. They are now making 550 wheels a day and will be able to turn out 650 when the additions to their plant are completed.

The Shirley Radiator & Foundry Co., of Shirley, Ind., reports every department very busy and states that it is exceedingly difficult to obtain as many molders as are required for its work.

The Schwab Safe & Lock Works, of Lafayette, Ind., are enlarging their works by the erection of a new foundry. The new building will be 60 by 120 ft.

The United States Brass & Specialty Co., of South Bend, Ind., has been incorporated with a capital of $10,000. The incorporators are Chas. T. White, Dr. Edwin P. Moore and Wm. H. Birwith.

The Quincy Stove Mfg. Co., of Quincy, Ill., have decided to build an addition to their foundry during the coming year. They have also elected the following officers for the ensuing year: President, August Heidbreder; vice-president, Nicholas King; secretary, Julius Klemme; assistant secretary, Chas. Heidbreder; treasurer, H. C. Sprick.

The Reedy Foundry Co., Chicago, has been incorporated with a capital of $50,000 to do a foundry and machine shop business. The incorporators are: W. H. Reedy, W. E. Wakefield and Joseph Price.

The Marinette Gas Engine Co., Chicago Heights, Ill., recently increased its capital from $250,000 to $400,000. The additional capital will be used in increasing the output of the company and also in equipping the plant with additional modern tools as they may be required.

The St. Charles Brass Mfg. Co. has changed its location from St. Charles to Elgin, Ill., and its name has been changed to the Elgin Brass & Electrical Mfg. Co. It has also increased its capital from $5,000 to $10,000.

The Western Foundry Co., of Chicago, Ill., has increased its capital stock from $100,000 to $200,000.

H. A. Scharrs is planning to build a foundry in Abingdon, Ill. The building will be 100 by 200 ft.

The Pratt Foundry of Joliet, Ill., will double its present capacity. This plant has been in existence but three years, but has had a phenomenally rapid growth.

The National Machine Works, of Chicago, Ill., whose plant was recently destroyed by fire, will rebuild and resume business as soon as circumstances will permit.

The Kemp Mfg. Co., of Kankakee, Ill., has been incorporated with a capital of $55,000. The company will do a general foundry and manufacturing business.

The foundry of the Port Huron Engine & Thresher Co., of Port Huron, Mich., which has been closed down all winter, has been started up once more.

At the annual meeting of the Detroit Foundry & Mfg. Co., Detroit, Mich., the following officers were elected: F. D. Bromley, president; J. W. Thompson, vice-president; C. F. Lawson, secretary and treasurer. Also the following directors: J. W. Thompson, F. L. Bromley, C. F. Lawson, N. D. Carpenter, W. H. Miller, H. S. Taylor and W. Thompson.

The Enterprise Foundry Co., of Detroit, Mich., has elected the following officers for the ensuing year: President, Frank Smith; vice-president, Emil Zanwanseele; secretary and manager, Charles W. Carolian; treasurer, Geo. S. Cuddy.

Mr. T. J. Thompson, proprietor of Thompson's Foundry, of Duluth, Minn., has been refitting his foundry since the fire which damaged the property some time ago. He has a new line of tools and is ready for business once more.

The Menominee Electrical Mfg. Co., of Menominee, Mich., have decided to rebuild their shop and foundry which was burned recently.

H. L. Maxfield, Norman Carle and others, of Janesville, Wis., have organized a company to build a $20,000 foundry for producing gray iron castings.

The Rogers Locomotive Works, of Paterson, N. J., has been purchased by the American Locomotive Co.

The Northwestern Foundry & Supply Co., Detroit, Mich., has increased its capital from $50,000 to $100,000. The new issue consists of $60,000 common and $40,000 preferred, all fully paid. The company has just completed an addition to its foundry 64 by 120 ft. The following officers have been elected for the ensuing year: H. D. Keller, president; Thos. E. Robinson, secretary and treasurer and John F. Sheaning, vice president. Frank H. Keller has been added to the board of directors.

The Riverside Foundry Co., of Kalamazoo, Mich., report a very prosperous year for 1904, and have elected the following officers for the ensuing year: M. J. Bigelow, president; W. M. Pomeroy, vice-president; A. M. Daily, treasurer; Millard Richardson, secretary and manager.

The St. Paul Foundry Co., St. Paul, Minn., has been awarded the contract for repairing the high bridge at St. Paul destroyed in a storm last August. The contract will amount to $59,000.

The Detroit Register Co., incorporated in Detroit for $15,000 in February, 1899, has filed articles of removal from Detroit to Milan; also articles of increase in capital stock to $50,000, of which $40,000 has been paid in.

The John Watson Sons Co., of Trenton, N. J., has been incorporated with a capital of $60,000. They expect to do a general foundry business. The incorporators are John Watson, William N. Watson and Samuel E. Watson.

The Empire Foundry Co., of New Brunswick, N. J., are planning to absorb the Criterion Gas Stove Co., of New York, N. Y., and to bring all the work to their plant at New Brunswick, N. J. This will necessitate some additions to their plant.

The deal for the purchase of the Newport Foundry & Machine Co., Newport, Ky., by molders who have been on a strike for some time, has been completed, $43,100 being paid for the plant. Negotiations were broken off through the interference of President Valentine, of the Molders' Union of North America, and Mr. Weber made arrangements to dismantle the plant and take the building, which is of steel construction, apart. After the work of removal had actually begun, the strikers decided to ignore Valentine, and said they would buy the plant regardless of his dictation. They soon came to an agreement with Mr. Weber. Saturday night the non-union men marched out and for the first time since September saw the outside world. The strikers marched into the plant and took possession. Articles of incorporation for the new company have been filed. It has a capital of $40,000, consisting of 160 shares of $250 each. It has 31 stockholders.

The plant of the Wheeling Ventilating & Foundry Co., of Elm Grove, W. Va., has been formally transferred to the Wheeling Mfg. & Supply Co., who will operate it in future. The former company was organized about two years ago and operated for a short time, but meeting with various difficulties, was forced to go into the hands of a receiver, and the new company, which was organized by the creditors, secured the plant and intends to carry on the business for which the plant was originally constructed.

The Mountain City Foundry & Machine Works is to be incorporated by W. G. Gregory and his associates, at Greenville, S. C. They will erect a machine shop 32 by 50 ft., boiler room 18 by 24 ft., and a foundry 20 by 40 ft.

The Demopolis Foundry & Machine Co., of Demopolis, Ala., has been incorporated with a capital of $50,000. The incorporators are A. R. Smith, L. W. Spaulding and W. M. Spencer.

The Western Car & Foundry Co., of Anniston, Ala., will rebuild the foundry of the car plant which was destroyed by an explosion about two years ago.

The Dimmick Pipe Co., of Birmingham, Ala., will enlarge its plant and increase its capacity 100 tons per day.

The plant of the Watkins Foundry & Machine Co., of Hattiesburg, Miss., which was destroyed by fire recently with a loss of $9,000, and having insurance amounting to $3,200, will be rebuilt at once.

The Gibson-White Co., of Chattanooga, Tenn., has been incorporated with a capital of $10,000 to manufacture stoves, sheet iron ware, and also to do a general foundry business. The incorporators are Filmore Gibson, William White, W. E. White, C. A. White and D. S. Adams.

The Clarksdale Machinery, Supply & Mfg. Co., of Clarksdale, Miss., has been incorporated with a capital of $10,000 and will erect a two-story building 50 by 160 ft., to be used as a foundry and machine shop.

The Charleston Machinery & Mfg. Co. has been incorporated at Charleston, S. C., with a capital of $50,000, to do a general foundry and

machine shop business. The incorporators are Armin Hartrath, A. S. Dickison, Chas. Shimer, J. Ross Hanahan, Julian Mitchell Jr., and Geo. H. Moffett.

The plant of the Tennessee Stove and Foundry Co., at Ridgedale, near Chattanooga, Tenn., is practically completed and they expect to begin operations very soon.

The Oregon Iron & Steel Co., Portland, Ore., has for a second time won a suit involving the ownership of a large meteorite whose possession was claimed by several persons. In instructing the jury the court held that while the meteorite came from without the world and was the property of no one, still it was to be considered the gift of God to the man on whose property it was deposited. The discovery of the meteorite was made by two prospectors, Ellis Hughes and William Dale, in the autumn of 1902, and claiming the ownership by right of discovery, they moved it from the property of the Oregon Iron & Steel Co. Two other men who owned land in the vicinity also set up property rights for the meteorite, which weighs 18 tons, is 25 ft. at the circumference of the base, and is four ft. high by seven ft. wide. An analysis shows that it contains 91.65 percent iron.

The F. S. Cronk Co., recently organized at Waxahachie, Texas, has leased the plant owned by T. R. Anderson and opened a machine shop and foundry.

The Sioux City Foundry & Mfg. Co., Sioux City, Iowa, builder of the Norfolk warm air furnace, will enlarge its plant and make large additions to its machinery equipment.

F. W. Braun & Co., of Los Angeles, Cal., have received gold medals covering practically their entire line of appliances and apparatus for assayers, metallurgists and chemists, which were exhibited in three groups at the Louisiana Purchase Exposition.

The Novelty Gray Iron Foundry Co., Dallas City, Tex., has been incorporated with a capital of $10,000. The incorporators are: Phil Schanz, Edgar P. Schanz and Harry A. Schanz.

The Hopkins Bros.-Springer Co., of Des Moines, Ia., are preparing to increase their equipment for manufacturing their brazing compound and brazing equipment. Their compound is known as brazol and is used for brazing cast iron, steel, or malleable iron.

The O. S. Kelly Western Mfg. Co. will erect a new foundry in East Iowa City, Ia.

The Farmers' Mutual Co-operative Association, of Blue Rapids, Kans., have completed their foundry and machine shop and are now ready for business.

The Lewiston Foundry & Machine Co., of Lewiston, Idaho, has increased its capital stock from $20,000 to $50,000.

The Independence Iron Works Co., of Ramona, Indian Territory, expect to have their new foundry in operation in the near future.

The Kingsland-Kay-Cook Mfg. Co., St. Louis, Mo., has purchased the business of the Central Union Brass Co., the Kay-Pin Mfg. Co. and the Kingsland Foundry Co., all of St. Louis. The new company will make a complete line of electric railway supplies, car trimmings, power transmission machinery and elevating and conveying appliances, also general iron and brass castings. The company does not expect to make any additions to its various plants at present, but it expects to add a complete line of metal working machinery in the very near future.

Seymour R. Church, of San Francisco, Cal., is still acting as agent for J. H. Gautier & Co.'s crucibles, and also continues to deal in foundry facings and pig iron, coke, fire brick and other foundry supplies. It is true that the old firm has been dissolved and that Schmidt & Faure are also dealing in the same line, but they do not succeed to the business of the Seymour R. Church Co., the fact being that the firm has been dissolved, and both divisions have gone into business for themselves.

H. J. Frank, whose foundry at Davenport, Ia., has been leased to the Red Jacket Pump Works, has, at the expiration of the lease, decided to start up the foundry once more.

David Fitzgerald will start a foundry and machine shop at LaGrande, Ore.

The citizens of Woodburn, Ore., have raised a cash bonus and given a building site to John McKinney, of Bremen, Ind., to induce him to erect a foundry at Woodburn, Ore.

The Carleton Foundry Co., of Peterborough, Ont., has elected the following directors: H. Colby Smith, J. J. Gordon, W. E. Scully, E. McLeod, W. J. Irons, W. A. Cathers and W. G. Haslam.

The Sonora Foundry, of Hermosillo, Sonora, Mexico, has been started recently, with Mr. Jose H. Aguilar as manager. Mr. Aguilar was educated at the Massachusetts Institute of Technology and has had shop experience in the United States. He will have a well equipped foundry and machine shop.

The Johnstown Foundry, Machine & Car Co., of Johnstown, Pa., has been incorporated with a capital of $30,000.

The Vulcan Machine & Foundry Co., of Birmingham, Ala., has been incorporated with a capital of $10,000 to operate the plant of the Wulburn Machine & Foundry Co., which they recently purchased. The officers of the company are Edward H. Wingate, president; Geo. W. Hays, secretary and treasurer.

The foundry connected with the plant of the Wm. R. Trigg Co., of Richmond, Va., which is now in the hands of a receiver, has been leased and will be operated by W. H. Woody, Jr., and Chas. Winburne, under the name of the Shockoe Foundry Co. These men were both connected with the company before it passed into the hands of a receiver.

The Farmers' Bank & Trust Co., of Henderson, Ky., has sold the Frayset Foundry & Machine Works to J. F. Hite, of Owensboro, Ky.

The Foster Mfg. Co., of St. Louis, Mo., has been incorporated with a capital of $50,000 to manufacture and deal in stoves. The incorporators are Robert M. Foster, S. Lowry, of St. Louis, T. J. Mitchell, of Helena, Ark., and R. P. Martin, of Jonesboro, Ark.

The Mesta Machine Co., of Pittsburg, Pa., has completed plans for the erection of a new foundry, whose melting capacity will be double that of the present plant. The old foundry will be used as an extension to the boiler shop. The new foundry will be 1,200 by 210 ft., and will connect with the old shop. The present foundry contains six air furnaces, and these will be increased to twelve in the new plant. The two steel furnaces in the present plant will be increased to four in the new plant. Four additional cupolas will also be added to the present equipment. They have a new brass foundry now under construction.

The Schuchert Pattern Works Co., of Cincinnati, O., has been incorporated with a capital of $10,000. The incorporators are Clarence Oskamp, A. F. Schuchert, A. W. Bauer, W. B. Hermeling and A. E. Herbstet.

S. R. Slaymaker, of Lancaster, Pa., has bought the entire business, machinery, patterns, tools, etc., of the Thomas Slaight Lock & Mfg. Co., of Newark, N. J.

The Parsons Foundry & Machine Works, Parsons, Kansas, which has recently been purchased by Millard F. Smith & Co., will be enlarged and improved by adding a two-story building, 35 by 50 feet, as a brass foundry and also by the installation of a new crane for handling heavy castings, and a new hoist for handling the iron to the cupola charging floor.

The Dillon Iron Foundry, Dillon, S. C., has been organized, and the following were elected directors: J. D. Haseldon, chairman; T. B. Stackhouse, J. W. Moore, Dr. J. H. David, T. G. King, J. H. Hamer, T. A. Dillon. The president will be elected at the next meeting of the directors, which will be held next week.

The Detroit Automatic Stoker Co., of Detroit, Mich., has been absorbed by the Detroit Foundry & Mfg. Co., and the two companies will conduct business under the name of the Detroit Stoker & Foundry Co., with a capital stock of $110,000. The union of the two companies will enable them to increase their business and serve their customers better. The officers of the new company are F. L. Bromley, president; J. W. Thompson, vice president, and C. F. Lawson, secrtary and treasurer.

The Perth Amboy Foundry & Machine Co., of Perth Amboy, N. J., has been incorporated with a capital of $100,000. The stockholders are Freeholder Peter A. Johansen, Mary Johansen and Hugh Dickson.

The F. F. Collins Mfg. Co., of San Antonio, Texas, has sold its entire stock of supplies, its equipment and good will to the San Antonio Machine & Supply Co., of the same city. The F. F. Collins Co. has been in business in San Antonio more than twenty years and is very well known throughout the Southwest.

The Los Angeles Engine Works, of Los Angeles, Cal., has been incorporated with a capital of $50,000, and will carry on a general foundry and machine shop business. The incorporators are W. C. F. Woodward, A. H. Ruggles, J. Hawkins, Anna M. Horncastle and Laura C. Hawkins, all of Los Angeles.

The Bessemer Foundry & Machine Co., and the Union Car Wheel Co., have been incorporated under the laws of Delaware by foundrymen of Pittsburg. The Bessemer Foundry & Machine Co. has a capital of $50,000 and the incorporators are J. K. Neagley, D. B. Neagley, and L. E. McKain. The Union Car Wheel Co. will erect a plant for the manufacture of car wheels and will have a capacity of 250 wheels a day.

The Standard Sanitary Mfg. Co., Beaver Falls, Pa., has purchased a building and will convert it into a foundry. The company expects to have it in operation within 30 days.

Undisplayed Advertisements.

Rate 40c per line each insertion beginning with April issue.
Answers sent in our care will be forwarded.

FOR SALE.—No. 10 Sturtevant fan, nearly new, in first-class condition. Address Box 995, BALTIMORE, MD.

WANTED.—Second-hand pulley molding machine, with patterns; for pulleys, up to 36 inches. Box L., Station B., CINCINNATI, O.

WANTED.—First-class brass molder for floor work; state wages wanted and give reference. Address Box 371, THE FOUNDRY, CLEVELAND, O.

SAMPLES FREE.—Compo Crayons for marking castings, etc.; better and cheaper than talc. Address D. M. STEWARD MFG. CO., CHATTANOOGA, TENN.

WANTED.—Cupola Man who understands melting brass in cupola; state experience, wages and references. Address Box 372, THE FOUNDRY, CLEVELAND, O.

FOUNDRY FOR RENT.—20-ton cupola. Can start on our work at once. Cheap rent. Located in good city. Address Box 403, THE FOUNDRY, LAND, O.

WANTED.—Experienced foundry foreman desires position in soft plate or light grey iron work. First-class reference from present employer. Address Box 436, SYRACUSE, N. Y.

FOR RENT.—Machine shop and foundry. Centrally located. Only one other foundry in city. Population from 15,000 to 18,000. Address Box 400, THE FOUNDRY, CLEVELAND, O.

FOR SALE.—Complete working drawings for annealing furnace, air furnace, and reverberatory furnace, furnished at reasonable prices. Address Box 399, THE FOUNDRY, CLEVELAND, O.

WANTED.—By practical iron molder, situation as foreman; has had many years' experience in heater and stove plate work, bath tubs and laboratories. Address Box 395, THE EOUNDRY, CLEVELAND, O.

FLUOR SPAR.—Every grade. Quotations delivered anywhere. Cheapest suppliers. Address GEO. G. BLACKWELL SONS & CO., Ltd., Liverpool, Eng., or agents Penna. Salt Mfg. Co., Pittsburg, Pa.

FOR SALE.—Green Positive Pressure Blower made by Wilbraham-Baker Blower Co., Philadelphia. Size No. 3. Used but little. In first-class condition. Address H. W. CALDWELL & SON CO., CHICAGO.

WANTED.—First-class brass foundry foreman who has had experience on large brass and bronze machinery castings. State wages wanted and give reference. Address Box 370, THE FOUNDRY, CLEVELAND, O.

FLUOR SPAR.—We furnish best grades on the market. Ground lump or gravel. No order too small for our attention nor too large for our capacity. Prices on request. KENTUCKY FLUOR SPAR CO., MARION, KY.

POSITION WANTED.—Foreman patternmaker desires to make a change. Progressive. Large experience on all classes of work. Good executive ability. Hustler. American, 39 years old. Address Box 398, THE FOUNDRY, CLEVELAND, O.

MANAGER or SUPERINTENDENT of foundry, thoroughly competent, practical, up-to-date in modern methods, desires to make a change; reference good; solicits correspondence. Address Box 406, THE FOUNDRY, CLEVELAND, O.

WANTED.—A foundry foreman capable of taking full charge of foundry handling heavy machine castings. One who is willing to buy an interest preferred. Established business and a good chance for the right man. Address "FOUNDRY," P. O. BOX 816, ST. LOUIS, MO.

HEATER MANUFACTURERS ATTENTION.—I am a foundryman with an extended experience on the above goods. Would like to open a correspondence with a view of engaging. Will furnish A1 references from past employers. Can mix from analysis and handle help with intelligence. Address Box 407, care THE FOUNDRY, CLEVELAND, O.

WANTED.—Working foreman for small iron foundry working two or three molders, melting two or three tons three times a week. Address SOULE STEAM FEED WORKS, MERIDIAN, MISS.

WANTED.—Core room foreman, experienced in handling men and familiar with work similar to small gas engine cores for automobile work. Good wages and steady work for the right man. Address THOS. B. JEFFERY & CO., KENOSHA, WIS.

WANTED.—Second-hand 30-ton cupola in good condition. Address Box 393, THE FOUNDRY, CLEVELAND, O.

BLOWER BARGAINS.
Roots Second-hand Blowers, bought, sold or exchanged for new ones. Address,
H. M. PAPWORTH,
120-122 Liberty street, New York City.

WANTED.—A second-hand foundry cupola in good condition—capacity, fifteen tons per hour. Address Box 394, THE FOUNDRY, CLEVELAND, O.

WANTED.—Position as foundry foreman, 25 years' practical experience on heavy and light machinery castings, also molding machine; 8 years a foreman. A No. 1 mixer of iron and handler of men. First-class reference. Address Box 404, THE FOUNDRY, CLEVELAND, OHIO.

POSITION WANTED.—By a foundry foreman who would like to make a change. A practical molder with a technical education. Can mix iron by analysis, and make analysis if necessary. An A1 cupola man. Address Box 401, THE FOUNDRY, CLEVELAND, O.

FOR SALE.—Foundry, machine and boiler shop. Best equipment within radius of 300 miles. Excellent and growing field for manufacture. Town 10,000 in Oregon. Mining, Agriculture, Saw Milling. Price right. Terms easy. Address "OREGON," Box 408, care THE FOUNDRY, CLEVELAND, O.

FOR SALE.—Manufacturing site occupied by the Brylgon Foundry; located on Lafayette Street in the city of Reading, along Lebanon Valley Railroad; lot 475 x 90 feet; large buildings with power plant; with or without machinery; possession at once. Apply to MENGEL & MENGEL, 9 North 6th Street, READING, PA.

WANTED.—Position as foundry foreman by a young man competent to handle a large force. Wide experience in green, dry sand, loam and molding machines, cupola practice and mixing iron; one competent to put a foundry on systematic working basis. A1 references. Address Box 397, THE FOUNDRY, CLEVELAND, O.

WANTED.—Foundry foreman, capable of taking charge of foundry making light automobile gas engine cylinders and similar work. One experienced in handling men and familiar with molding machines and with different iron mixtures. Good wages and steady work for the right man. Address THOMAS B. JEFFERY & CO., KENOSHA, WIS.

WANTED.—A practical molder, with 21 years' experience on stove plate, heater work and general jobbing, six years as foreman, would like to correspond with some firm who wants a foreman, or assistant superintendent; can mix and melt iron and handle men to good advantage. Good references. Address Box 402, THE FOUNDRY, CLEVELAND, O.

WANTED.—Manager, six o'clock man, energetic, with practical engineering experience, wanted to take charge from March, of new foundry and pattern shop, output 300 to 500 tons per month. Applications to be favorably considered must state fully and accurately ideas as to shop management and control of foremen, also experience and where gained, of cupola practice, mixing of metals, coke consumption, pattern-making, plate and machine molding. Applicants should also state class of work previously engaged in producing. Technical education a recommendation. Present manager regrets giving up owing to ill health. Applications treated in strictest confidence. Apply giving age and salary expected to "MANAGER," care WM. PORTEOUS & CO., GLASGOW, SCOTLAND.

(Continued on page 46.)

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PIG IRON ENCYCLOPÆDIA

A continuation of PIG IRON and COKE brands from last month.

HERE IS SHOWN: BRAND, NAME OF FURNACE COMPANY, SHIPPING POINT, CHARACTERISTICS, AND OTHER DETAILS.

BATTELLE— The Lookout Mountain Iron Co., Battelle, Ala. The latest in Southern pig iron. Standard Alabama coke iron made from choice local hard and soft red, and mixture of brown ores with fuel from the company's own property. Grading high. High in Silicon, exceptionally low in Sulphur, low in Phosphorus. Every cast analyzed. Sales made by fracture or analysis grading. Capacity 300 tons daily.

BELFONT— Belfont Iron Works Co., Ironton, Ohio. Bessemer, Foundry and Forge iron made with coke fuel from selected Lake Superior Ores. Noted for strength, softness and high grading. An excellent all around Foundry iron and famed as a heavy scrap carrier. Sold on fracture grading only. Capacity 175 tons daily.

BIG STONE GAP— Union Iron & Steel Co., Big Stone Gap, Va. Coke iron made from selected Virginia Ores. Strong and Soft, Neutral Foundry and high silicon, low sulphur Pig Iron, suitable for the best grade of general castings. Sales made by analysis or fracture grading. Capacity 140 tons daily.

BUENA VISTA— Alleghany Ore & Iron Co., Buena Vista, Va. Coke iron made from Oriskany, Reid and Lake Ores. Basic, Special Car Wheel and Foundry iron, both chill and sand cast. Being high in Manganese the fracture is close and well adapted where strength and density are desired. Low in Phosphorus. Silicons as desired. Sold by fracture or analysis grading. Capacity 165 tons daily.

(To be Continued)

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